INDEPENDENT ORBITER ASSESSMENT

ASSESSMENT
OF THE
AUXILIARY POWER
UNIT

19 FEBRUARY 1988

MCDONNELL DOUGLAS ASTRONAUTICS COMPANY HOUSTON DIVISION

SPACE TRANSPORTATION SYSTEM ENGINEERING AND OPERATIONS SUPPORT

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CONTENTS

			Page
1.0	EXEC	UTIVE SUMMARY	1
2.0	INTR	ODUCTION	4
	2.1	Purpose	4
	2.2	Scope	4
		Analysis Approach	4
	2.4	APU Ground Rules and Assumptions	5
3.0	SUBS	YSTEM DESCRIPTION	6
		Design and Function	6
		Interfaces and Locations	8
	3.3	Functional Breakdown	8
4.0	ASSE	SSMENT RESULTS	24
	4.1	Power Subsystem Assessment Results	27
		Fuel Subsystem Assessment Results	27
	4.3	Lube Oil Subsystem Assessment Results	28
	4.4	Gas Generator Injector Cooling Subsystem Assessment Results	29
	4.5	Fuel Pump/GGVM Cooling Subsystem Assessment Results	30
	4.6	Structure Subsystem Assessment Results	30
		Electrical Subsystem Assessment Results	31
		Displays Subsystem Assessment Results	32
	4.9		32
	4.10	Controller Subsystem Assessment Issues	33
5.0	REFE	RENCES	34
APPE	NDIX	A ACRONYMS	A-1
APPE	NDIX	B DEFINITIONS, GROUND RULES, AND ASSUMPTIONS	B-1
	B.1	Definitions	B-2
		Project Level Ground Rules and Assumptions	B-4
	B.3	Subsystem Specific Ground Rules and Assumptions	B-6
APPE	NDIX	C DETAILED ASSESSMENT	C-1
APPE	NDIX	D CRITICAL ITEMS	D-1
APPE	NDIX	E DETAILED ANALYSIS	E-1
APPE	NDIX	F NASA FMEA TO IOA WORKSHEET CROSS REFERENCE/RECOMMENDATIONS	F-1

			List of Figures	
			-	Page
Figure	1	_	APU FMEA/CIL ASSESSMENT	3
			APU INTERFACES	9
Figure	3	_	APU LOCATION	10
Figure	4	_	APU FUNCTIONAL BREAKDOWN	12
Figure	5	_	APU TOP LEVEL HIERARCHY	13
Figure	6	_	POWER SYSTEM HIERARCHY	14
Figure	7	_	FUEL SYSTEM HIERARCHY	15
Figure	8	_	LUBE OIL SYSTEM HIERARCHY	16
Figure	9	_	GAS GENERATOR INJECTOR COOLING	17
•			SYSTEM HIERARCHY	
Figure	10	_	FUEL PUMP/GGVM COOLING SYSTEM HIERARCHY	18
Figure	11	_	STRUCTURES HIERARCHY	19
Figure	12	_	ELECTRICAL SYSTEM HIERARCHY	20
Figure	13	_	DISPLAYS HIERARCHY	21
Figure	14	-	INSTRUMENTATION HIERARCHY	22
Figure	15	-	CONTROLLER HIERARCHY	23
			List of Tables	
				Page

25

25

26

26

27

Table I - SUMMARY OF IOA FMEA ASSESSMENT

Table III - SUMMARY OF IOA RECOMMENDED FAILURE

Table IV - SUMMARY OF IOA RECOMMENDED CRITICAL ITEMS

Table II - SUMMARY OF IOA CIL ASSESSMENT

CRITICALITIES

Table V - IOA WORKSHEET NUMBERS

Independent Orbiter Assessment Assessment of the Auxiliary Power Unit FMEA/CIL

1.0 EXECUTIVE SUMMARY

The McDonnell Douglas Astronautics Company (MDAC) was selected in June 1986 to perform an Independent Orbiter Assessment (IOA) of the Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL). Direction was given by the STS Orbiter and GFE Projects Office to perform the hardware analysis using the instructions and ground rules defined in NSTS 22206, Instructions for Preparation of FMEA and CIL, 10 October 1986.

The IOA effort first completed an analysis of the Auxiliary Power Unit (APU) hardware, generating draft failure modes and potential critical items. To preserve independence, this analysis was accomplished without reliance upon the results contained within the NASA FMEA/CIL documentation. The IOA results were then compared to the NASA FMEA/CIL baseline with proposed Post 51-L updates included. A resolution of each discrepancy from the comparison is provided through additional analysis as required. This report documents the results of that comparison for the Orbiter APU hardware.

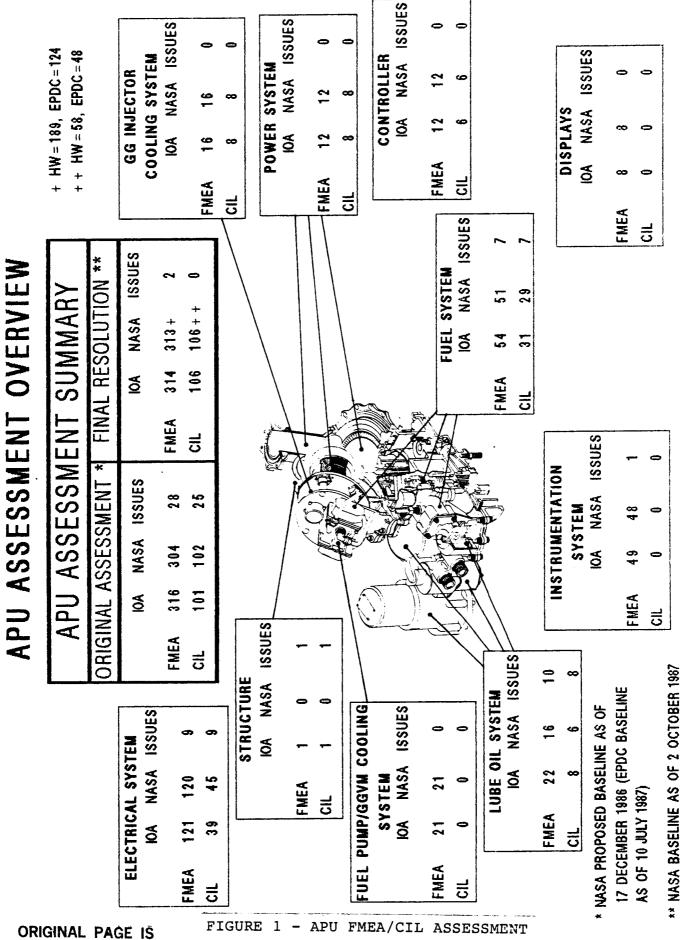
The IOA product for the APU analysis, covering both APU hardware and APU electrical components, consisted of 344 failure mode "worksheets" (301 original worksheets plus 43 supplemental worksheets) that resulted in 178 potential critical items being identified (149 original items plus 29 supplemental items). A comparison was made of the IOA product to the NASA APU hardware FMEA/CIL baseline dated 17 December 1986 which consisted of 184 FMEAs and fifty-seven CIL items. The comparison determined if there were any results which had been found by the IOA analysis of the APU hardware that did not agree with the NASA APU hardware The comparison identified seventy-two discrepancies. baseline. After discussion with the NASA subsystem manager, this list was reduced to nineteen issues which were taken by the subsystem manager to the NASA/Rockwell FMEA/CIL working group meetings for disposition. As a result of that review, four additional APU hardware FMEAS recommended by the IOA were added to the NASA proposed FMEA/CIL baseline, three of which were CIL items.

A comparison was made of the IOA product to the NASA proposed APU Electrical Power Distribution and Control (EPDC) CIL baseline dated 10 July 1987 which consisted of forty-five CIL items. The comparison identified nine discrepancies, which were provided to the NASA/Rockwell FMEA/CIL working group meetings for consideration. As a result of this review, all nine issues were resolved without adding any additional CIL's to the proposed NASA APU EPDC CIL baseline.

A comparison was made of the IOA product to the NASA proposed APU EPDC FMEA baseline dated 2 October 1987, which consisted of 124 FMEAs and forty-eight CIL items. No discrepancies were identified as a result of this comparison.

It should be noted that while this FMEA baseline package fully documented the forty-eight APU EPDC CIL items, allowing a thorough comparison, it provided only hardware item identification, failure mode, and criticality for the seventy-six non-CIL FMEAs. Assessment of these non-CIL FMEAs was done as well as it could be under the circumstances.

Figure 1 presents a comparison of the proposed post 51-L NASA baseline with the IOA recommended baseline and any issues. The number of IOA FMEAs and CIL items shown differ from those of the original analysis because they take into account the IOA/NASA discrepancies which were resolved before the twenty-eight issues (nineteen hardware issues and nine EPDC issues) shown were generated. As the numbers imply, not all issues involve adding or removing FMEAs or CIL items. Some involve changing criticalities or redundancy screens of existing FMEAs. The two remaining IOA issues shown are discussed in Section 4.



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2.0 INTRODUCTION

2.1 Purpose

The 51-L Challenger accident prompted the NASA to readdress safety policies, concepts, and rationale being used in the National Space Transportation System (NSTS). The NSTS Office has undertaken the task of reevaluating the FMEA/CIL for the Space Shuttle design. The MDAC is providing an independent assessment of the proposed Post 51-L Orbiter FMEA/CIL for completeness and technical accuracy.

2.2 Scope

The scope of the independent FMEA/CIL assessment activity encompasses those Shuttle Orbiter subsystems and GFE hardware identified in the Space Shuttle Independent FMEA/CIL Assessment Contractor Statement of Work. Each subsystem analysis addresses hardware, functions, internal and external interfaces, and operational requirements for all mission phases.

2.3 Analysis Approach

The independent analysis approach is a top-down analysis utilizing as-built drawings to breakdown the respective subsystem into components and low-level hardware items. Each hardware item is evaluated for failure mode, effects, and criticality. These data are documented in the respective subsystem analysis report, and are used to assess the proposed Post 51-L NASA and Prime Contractor FMEA/CIL. The IOA analysis approach is summarized in the following Steps 1.0 through 3.0. Step 4.0 summarizes the assessment of the NASA and Prime Contractor FMEA/CIL which is documented in this report.

- Step 1.0 Subsystem Familiarization
 - 1.1 Define subsystem functions
 - 1.2 Define subsystem components
 - 1.3 Define subsystem specific ground rules and assumptions
- Step 2.0 Define subsystem analysis diagram
 - 2.1 Define subsystem
 - 2.2 Define major assemblies
 - 2.3 Develop detailed subsystem representations
- Step 3.0 Failure events definition
 - 3.1 Construct matrix of failure modes
 - 3.2 Document IOA analysis results

Step 4.0 Compare IOA analysis data to NASA FMEA/CIL

- 4.1 Resolve differences4.2 Review in-house
- 4.3 Document assessment issues
- 4.4 Forward findings to Project Manager

Ground Rules and Assumptions 2.4

The ground rules and assumptions used in the IOA are defined in Appendix B.

3.0 SUBSYSTEM DESCRIPTION

3.1 Design and Function

The Auxiliary Power Unit (APU) subsystem converts chemical energy stored in liquid hydrazine to mechanical shaft power. The Orbiter has three completely independent APUs, with each APU driving one hydraulic pump.

Each APU subsystem consists of the following:

- o A fuel supply and distribution system
- o An auxiliary power unit and controller
- o An exhaust duct assembly
- o A fuel thermal control system
- o A fuel pump seal cavity drain line
- o A fuel pump/valve module cooling system
- o A gas generator injector cooling system

The hydrazine is delivered to the APU gas generator via the fuel pump. The catalyst in the gas generator causes the hydrazine to decompose. The hot gases make two passes through the turbine, which in turn provides mechanical power to the APU gearbox. Through gear reduction, power is provided to drive the APU fuel pump, lube oil pump, and hydraulic oil pump.

Three water tanks and associated lines are provided to cool the fuel pumps and gas generator valve modules after APU shutdown on-orbit and to cool the gas generator injectors should an emergency hot start be required.

The hydrazine fuel supply is stored in the fuel tank and is pressurized with nitrogen during servicing. The pressure provides start capability until the fuel pump is running and acts against the tank diaphragm to positively expel fuel to the APU. The fuel pump provides a constant flow of hydrazine to the valve module after the initial bootstrap start.

Two parallel fuel isolation valves are manually actuated by the crew during APU activation and deactivation. During nonoperating periods, they isolate the fuel supply to prevent further fuel flow. Each valve has a reverse-flow pressure-relief feature to prevent system damage due to expansion of fuel trapped between the valves and the APU.

The APU turbine speed is controlled by the Gas Generator Valve Module (GGVM). The valve module consists of two flapper-type valves in series. The primary or modulating valve downstream of the pump is normally open and allows flow to the secondary or shutoff valve. The secondary valve is normally in by-pass, which directs hydrazine flow back to the pump inlet. In the powered state, it allows hydrazine flow to the gas generator. The APU controller cycles these

valves to maintain proper turbine speed. The gas generator is a container for a granular catalyst. When hydrazine comes in contact with the catalyst, decomposition occurs, and the hot gases produced are directed to the turbine.

The dual-pass turbine assembly converts hot gas kinetic energy into mechanical shaft power at the desired speeds to operate the hydraulic pump, lube oil pump, and fuel pump.

The speed-reducing gearbox contains gears, bearings, seals, and a scavenger lubrication system. The gearbox is pressurized with nitrogen to prevent vaporization of the lubricant. A lube oil pump circulates the lube oil to the hydraulic water boiler for cooling. The gearbox has a pressurization system consisting of a small GN2 bottle and solenoid shutoff valve actuated by the controller.

The APU controller provides speed control, logic for APU startup and shutdown, signal conditioning, heater control, gearbox pressure control, and malfunction detection capability.

The exhaust duct assembly directs the APU exhaust products overboard through an exit at the upper aft fuselage skin. Exhaust duct assemblies 1 and 2 are located on the port side and duct 3 is on the starboard side of the aft fuselage at the base of the vertical stabilizer.

The fuel tank, fuel line, fuel pump, and lube oil line heaters are sized to maintain the fuel and lube oil above minimum temperature during any Orbiter mission. The gas generator heaters provide a means of preheating the catalyst to > 190 degrees F for controlled decomposition. Insulation for the APU prevents excessive temperatures in the fuel system as a result of entry heating.

The fuel pump and gas generator valve modules are maintained below 200 degrees F after APU shutdown by a water spray system consisting of two water tanks and associated lines, switches, thermostats, and timers. This system is only required on-orbit when convective cooling is insufficient to cool these components.

A single water tank with lines to all three APUs is provided to cool the gas generator injector should an APU restart be required before the gas generator can cool naturally. Control is via the APU controller.

3.2 Interfaces and Locations

Figure 2 depicts the APU interfaces. The APU and APU Controller receive electric power from various Orbiter Aft Load Controllers, Aft Power Controllers, Control Buses, and Essential Buses. APU gauges are powered by Panel Bus Main B 015.

All three APUs are mounted on the 1307 bulkhead, in the Orbiter aft compartment. APUs 1 and 2 are located in close proximity toward the port side of the bulkhead. APU 3 is slightly further away, toward the starboard side.

The APU fuel tanks are mounted on the sides of the aft compartment, about 7 feet aft of the 1307 bulkhead. Tanks 1 and 2 are on the port side, in close proximity. Tank 3 is on the starboard side. Figure 3 shows the locations of the three APUs and associated fuel tanks, fuel lines, and the lube oil lines.

APU lube oil cooling is provided by the Orbiter Water Spray Boilers, one for each APU.

The Controllers for APU 1, 2 and 3 are mounted on freon coldplates in Aft Avionics Bays 4, 5 and 6, respectively.

The APUs are controlled during flight by flight crew switches only - no uplink commands are possible. Many APU functions can be controlled from the ground prelaunch by way of the Launch Aft MDM, however.

3.3 Functional Breakdown

For analysis purposes, the APU was broken down into the following functional subsystems:

- 1. Power System
- 2. Fuel System
- 3. Lube Oil System
- 4. Gas Generator Injector Cooling System
- 5. Fuel Pump/GGVM Cooling System
- 6. Structure
- 7. Electrical System
- 8. Displays
- 9. Instrumentation
- 10. Controller

These subsystems are described below.

1. The Power System consists of the components involved in generating shaft power from the exothermic reaction - the gas generator, turbine wheel, exhaust duct, gearbox, gas generator bed heaters, and the turbine speed sensors.

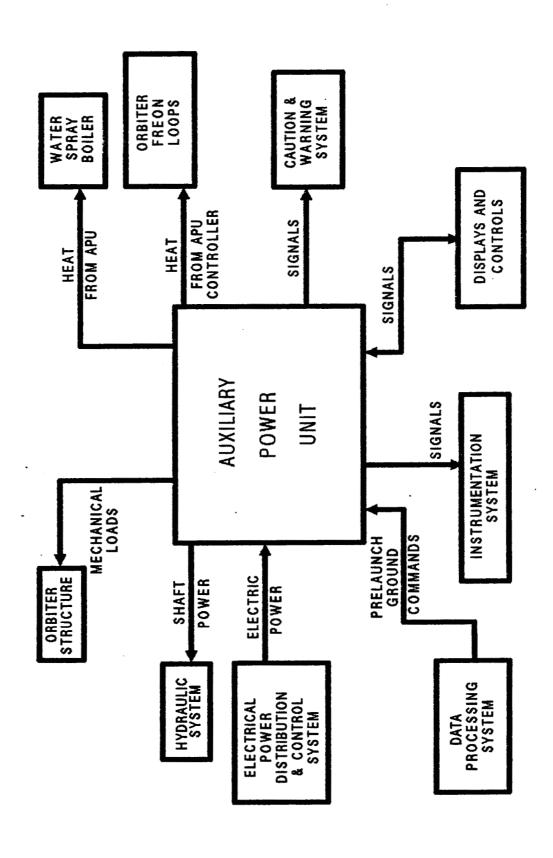


Figure 2 - APU INTERFACES

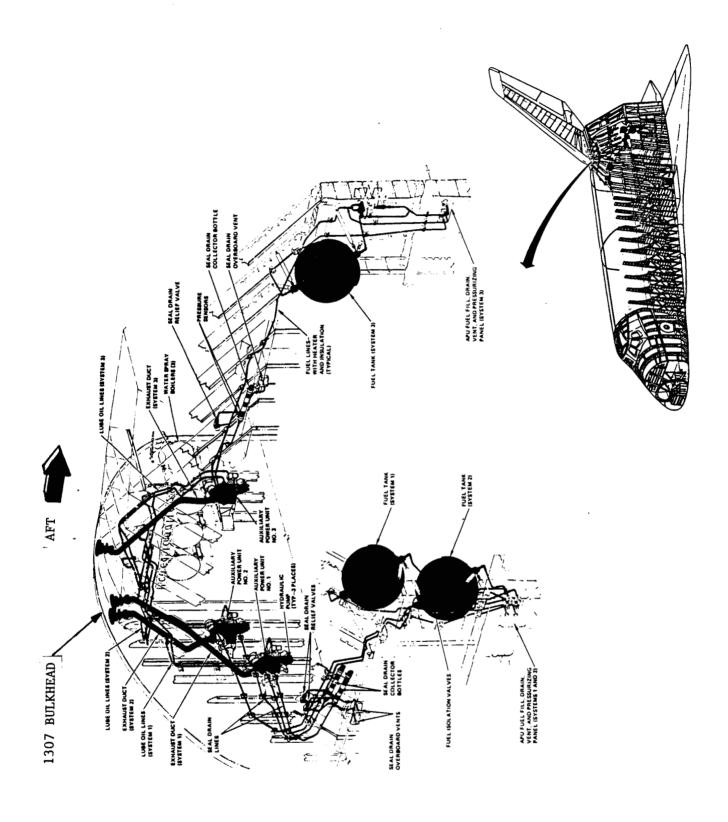


Figure 3 - APU LOCATION

- The Fuel System consists of all components involved in storing fuel, and supplying it to the gas generator the fuel tank, fuel lines, valves, fuel pump, and heaters.
- 3. The Lube Oil System includes the lube oil lines, pump, couplings, accumulators, and heaters.
- 4. The Gas Generator Injector Cooling System includes all valves, water tanks, water lines, couplings, and heaters associated with this cooling system.
- 5. The Fuel Pump/GGVM Cooling System includes all valves, water tanks, water lines, nitrogen lines, couplings, and heaters associated with this cooling system.
- 6. The Structures analyzed include the APU turbine and gearbox housings.
- 7. The Electrical System includes circuitry specifically associated with the APU, including the APU switches.
- 8. Displays include all APU gauges and talkbacks.
- 9. Instrumentation includes all APU transducers except for the turbine speed sensors, which are covered under the Power System.
- 10. The APU Controller was analyzed to the functional level only. The analysis examines the consequences of loss of the Controller's important functions.

Figure 4 presents a highly simplified breakdown of the APU components, reflecting the functional subsystems described above (except for the structures, electrical, displays, and instrumentation subsystems).

Figure 5 presents the top-level hierarchy used in the APU analysis.

Figures 6 through 15 present the breakdown hierarchy of the ten APU subsystems described above.

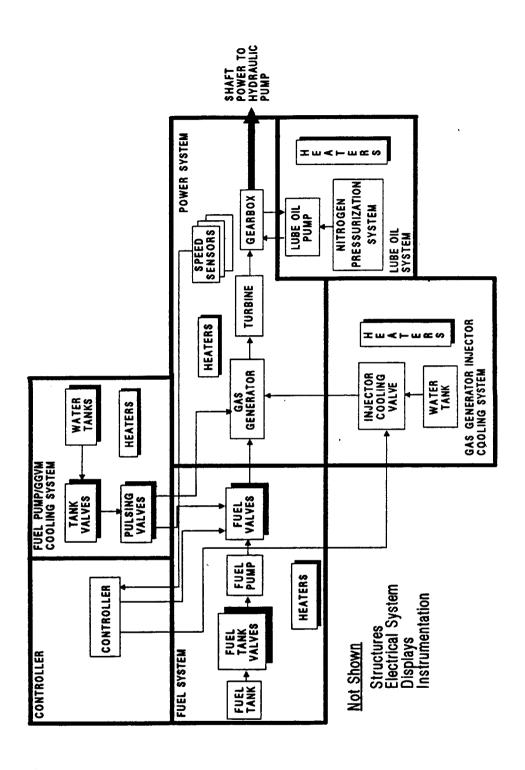


Figure 4 - APU FUNCTIONAL BREAKDOWN

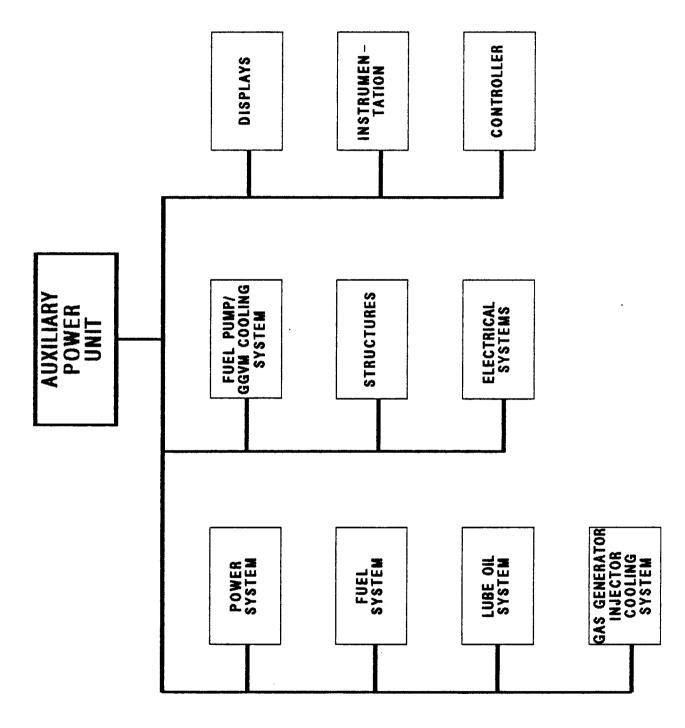


Figure 5 - APU TOP LEVEL HIERARCHY

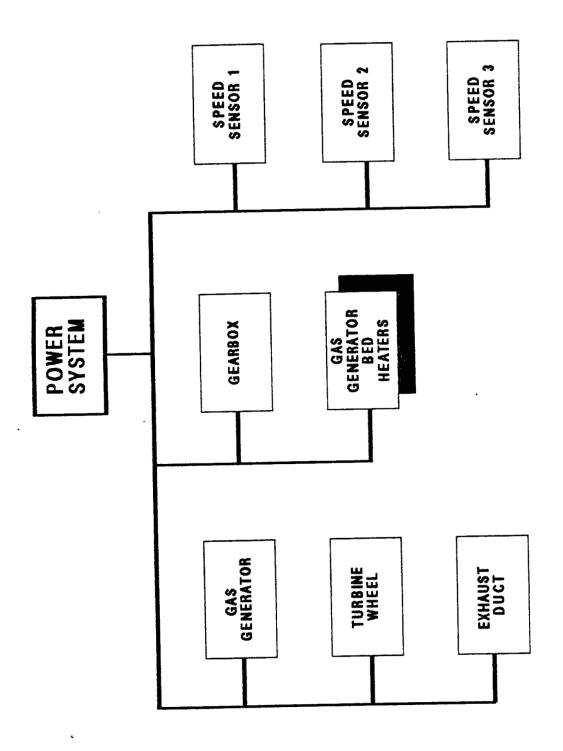


Figure 6 - POWER SYSTEM HIERARCHY

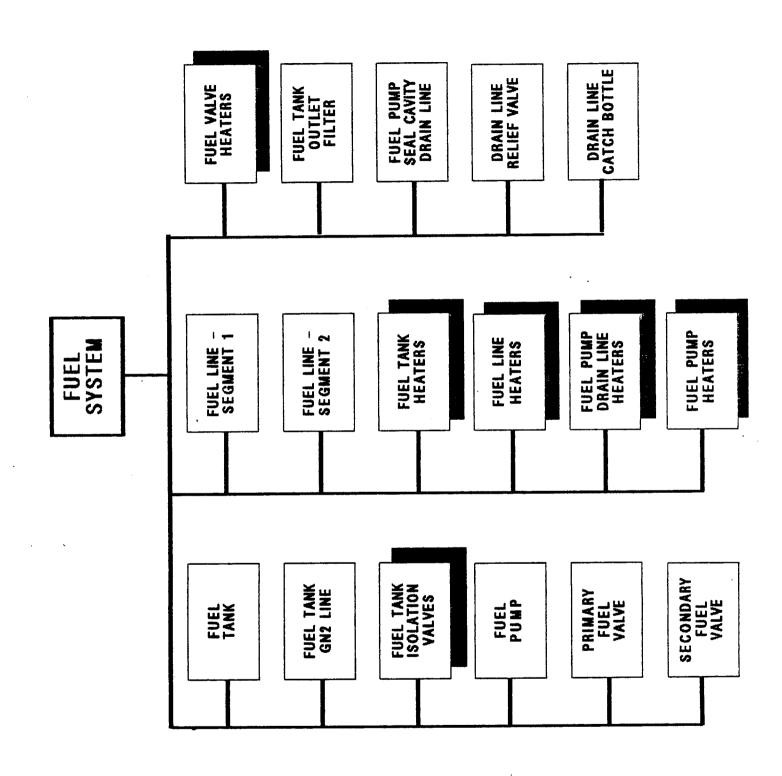


Figure 7 - FUEL SYSTEM HIERARCHY

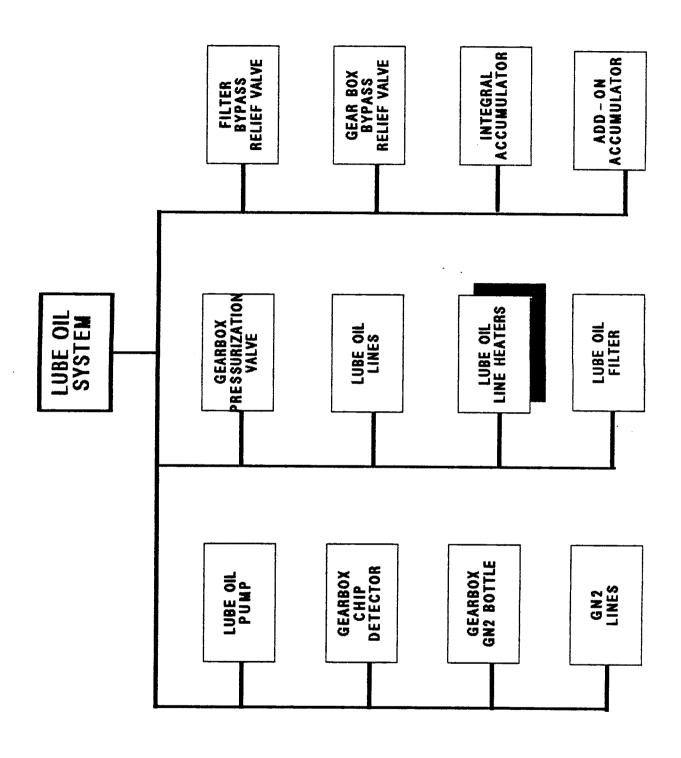


Figure 8 - LUBE OIL SYSTEM HIERARCHY

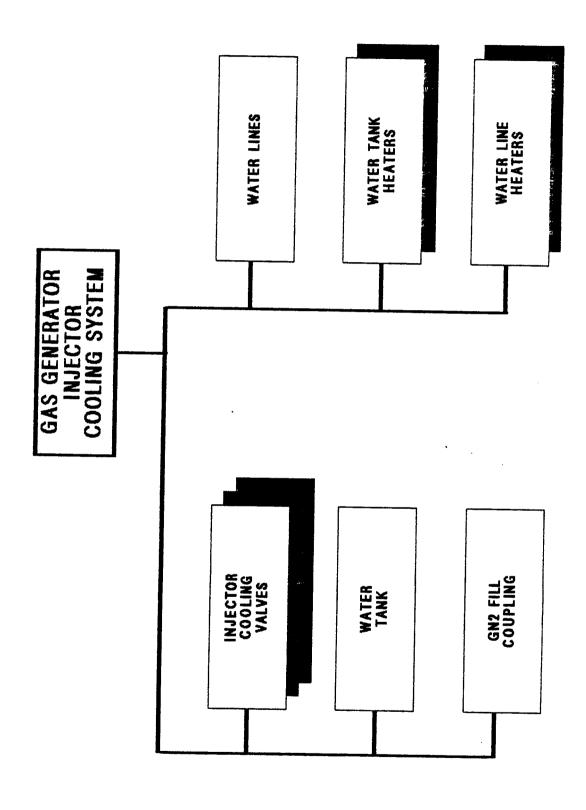


Figure 9 - GAS GENERATOR INJECTOR COOLING SYSTEM HIERARCHY

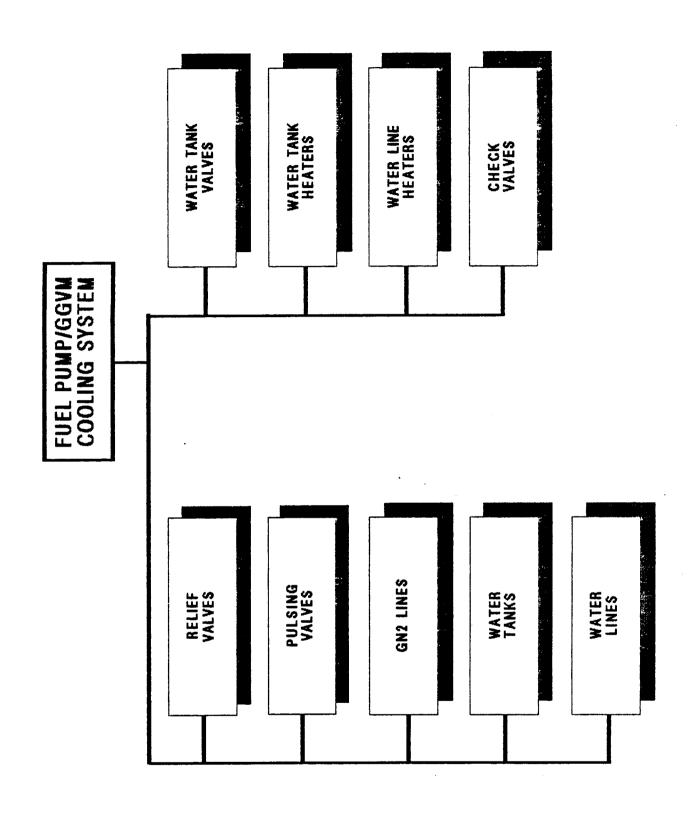


Figure 10 - FUEL PUMP/GGVM COOLING SYSTEM HIERARCHY

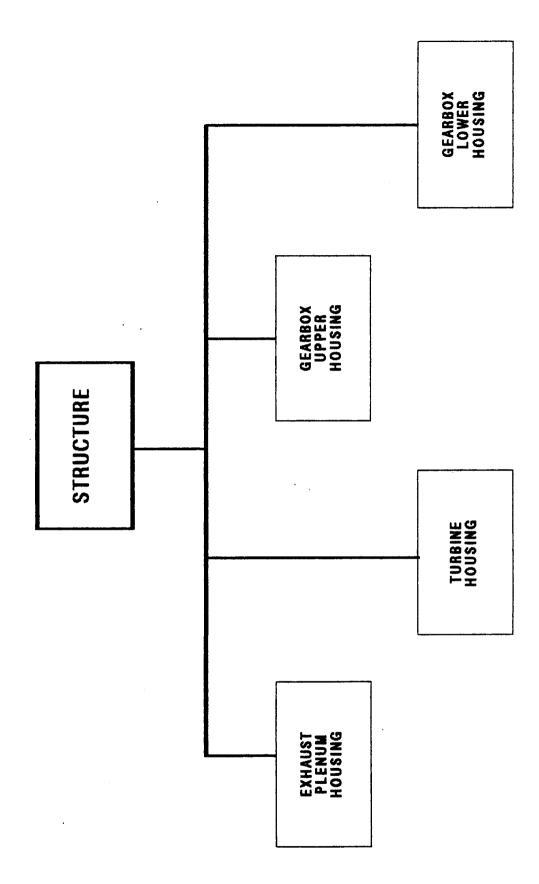


Figure 11 - STRUCTURES HIERARCHY

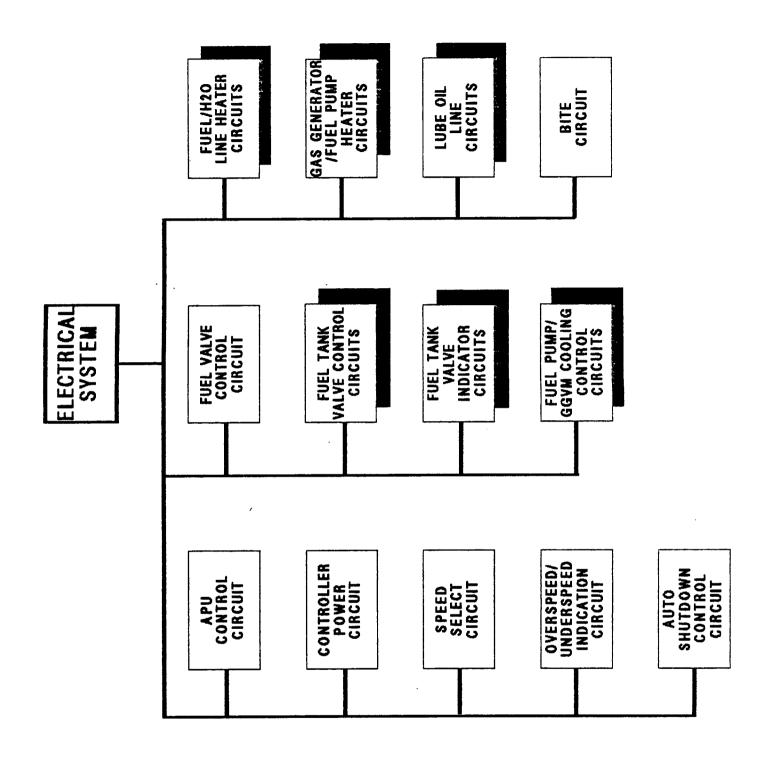


Figure 12 - ELECTRICAL SYSTEM HIERARCHY

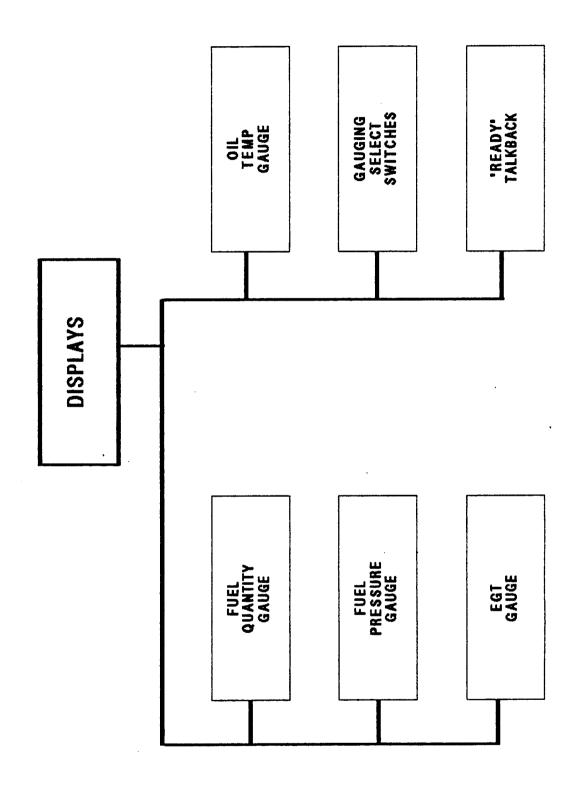


Figure 13 - DISPLAYS HIERARCHY

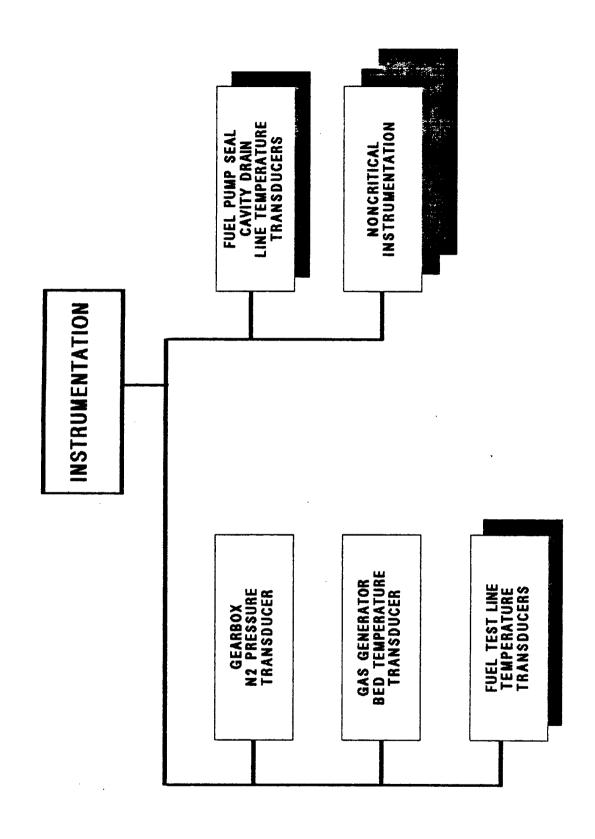


Figure 14 - INSTRUMENTATION HIERARCHY

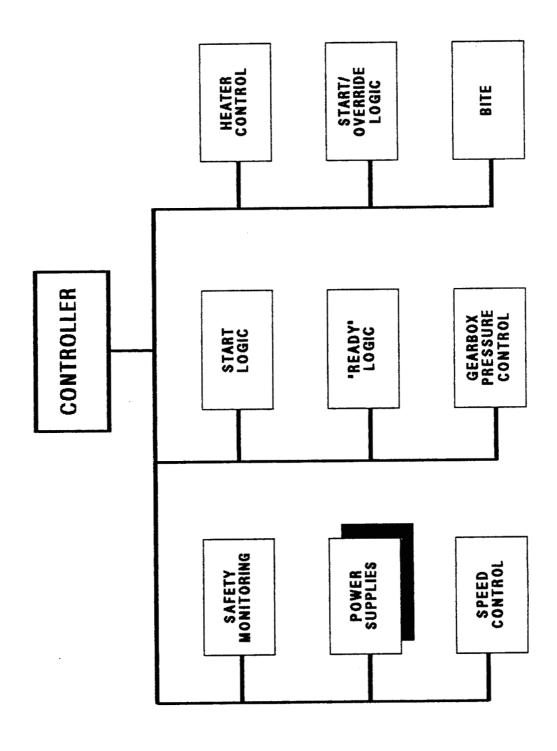


Figure 15 - CONTROLLER HIERARCHY

4.0 ASSESSMENT RESULTS

The IOA analysis of the APU subsystem initially generated 301 failure mode worksheets and identified 149 Potential Critical Items (PCIs) before starting the assessment process. In order to facilitate comparison, forty-three additional failure mode analysis worksheets were generated. These analysis results were compared to the proposed NASA Post 51-L baseline (17 December 1986) of 184 FMEAs and fifty-seven CIL items, and to the proposed NASA Post 51-L EPDC baseline (10 July 1987) of 120 FMEAS and forty-five CIL The discrepancy in the number of IOA and NASA FMEAs is due to the different approaches used by NASA and IOA to group failure modes. Upon completion of the assessment, and after a discussion with the NASA subsystem manager, nineteen hardware issues were carried to the NASA/Rockwell FMEA/CIL working group for consideration. These nineteen issues resulted in four new FMEAs being added to the NASA hardware FMEA baseline. assessment of the EPDC CIL items produced nine issues which were provided to the NASA/Rockwell FMEA/CIL working group for consideration. These nine issues were resolved satisfactorily without adding any FMEAs to the NASA APU EPDC baseline.

The assessment report divides the APU into the same ten subsystems used in the analysis report. The IOA electrical subsystem corresponds to the NASA APU EPDC FMEAS.

At the completion of the assessment, there are two remaining IOA issues. One involves the APU instrumentation, and is a carryover from the original nineteen hardware issues. The other is a new issue which arose as a result of a discrepancy identified between the APU hardware and APU EPDC FMEA criticalities. These two issues are discussed in Sections 4.9 and 4.7, respectively.

Appendix C presents the detailed assessment worksheets for each failure mode identified and assessed. Appendix D highlights the NASA Critical Items and corresponding IOA worksheet ID. Appendix E contains IOA analysis worksheets supplementing previous analysis results reported in Space Transportation System Engineering and Operations Support (STSEOS) Working Paper No. 1.0-WP-VA86001-14, Analysis of the Auxiliary Power Unit, 12 December 1986. Appendix F provides a cross-reference between the NASA FMEA and corresponding IOA worksheet(s). IOA recommendations are also summarized.

A summary of the quantity of NASA FMEAs assessed, versus the recommended IOA baseline, and any issues identified is presented in Table I.

Table I SUMMARY OF IOA FMEA ASSESSMENT							
Component	NASA	IOA	Issues				
Power	12	12	-				
Fuel	51	54	7				
Lube Oil	16	22	10				
GG Injector Cooling	16	16	-				
FP/GGVM Cooling	21	21	_				
Structure	-	1	1				
Electrical	120	121	9				
Displays	8	8	-				
Instrumentation	48	49	1				
Controller	12	12	_				
TOTAL	304	316	28				

A summary of the quantity of NASA CIL items assessed, versus the recommended IOA baseline, and any issues identified is presented in Table II.

Table II SUMMARY OF IOA CIL ASSESSMENT							
Component	NASA	IOA	Issues				
Power	8	8	_				
Fuel	29	31	7				
Lube Oil	6	8	8				
GG Injector Cooling	8	8	-				
FP/GGVM Cooling	-	-	-				
Structure	-	1	1				
Electrical	45	39	9				
Displays	-	-	_				
Instrumentation	-	-	_				
Controller	6	6	-				
TOTAL	102	101	25				

Table III presents a summary of the IOA recommended failure criticalities for the Post 51-L FMEA baseline. Further discussion of each of these subdivisions and the applicable failure modes is provided in subsequent paragraphs.

Table III SUMMARY OF IOA RECOMMENDED FAILURE CRITICALITIES							
Criticality:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
Power	3	4	_	2	_	3	-12
Fuel	6	21	-	14	6	7	54
Lube Oil	-	5	_	6	3	8	22
GG Injector Cooling	-	-		-	-	16	16
FP/GGVM Cooling	_	_	 -	i –	_	21	21
Structure	_	1	-	–	_	_	1
Electrical	1	11	3	39	17	50	121
Displays	-	_	_	-	2	6 .	. 8
Instrumentation	-	_	–	5	3	41	49
Controller	-	4	_	5	-	3	12
TOTAL	10	46	3	71	31	155	316

Of the failure modes analyzed, 101 were determined to be critical items. A summary of the IOA recommended critical items is presented in Table IV.

Table IV SU	J MMA RY	OF IOA	RECOM	MENDED (CRITICA	L ITEMS	3
Criticality:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
Power	3	4	-	1	_	_	8
Fuel	6	21	-	3	1	! –	31
Lube Oil	-	5	-	3	_	_	8
GG Injector Cooling	-	-	-	-	-	8	8
FP/GGVM Cooling	-	_	-	-	-	-	
Structure	_	1	-	_	_	_	1
Electrical	1	9	3	23	2	1	39
Displays	_	_	-	_	-	-	-
Instrumentation	-	_	-	_	_	_	-
Controller	-	4	-	1	-	1	6
TOTAL	10	44	3	31	3	10	101

The scheme for assigning IOA assessment (Appendix C) and analysis (Appendix E) worksheet numbers is shown in Table V.

	Table V IOA Worksheet Numbers
Component	IOA ID Number
Power Fuel Lube Oil GG Injector Cooling FP/GGVM Cooling Structure Electrical Displays Instrumentation Controller	APU-276 to APU-279 APU-280 to APU-363, APU-406X to APU-411X, APU-420X to APU-443X APU-364 to APU-373

4.1 Power Subsystem Assessment Results

The first assessment between the fourteen IOA failure modes and the Post 51-L NASA FMEA baseline produced one issue. This issue was an external leak in the exhaust duct bellows (MDAC ID 105). The IOA listed this as a separate failure mode, based on the NSTS 22206 rule concerning special lines (paragraph 2.3.7.c). In a meeting held on 29 January 1987, the NASA subsystem manager asserted that this rule did not apply to the APU exhaust duct, since it does not flex or bend while operating. He felt that the existing exhaust duct leakage failure mode was sufficient (FMEA 04-2-L4-11). The IOA agreed to accept this reasoning.

4.2 Fuel Subsystem Assessment Results

The IOA analysis generated seventy-four failure modes for this subsystem (seventy-two original failure modes plus two supplemental failure modes). The initial assessment between the IOA failure modes and the Post-51L NASA FMEA/CIL baseline produced thirty-one issues, including separate failure modes for "special lines" (MDAC ID 178), external leaks from additional components (MDAC ID 117, 129, 144, 150, 175, and 183), a higher criticality for fuel heaters and thermostats failing off (MDAC ID 160, 161, 163, 164, 166, 171, 172, 401X, and 402X), disagreements about redundancy screens (MDAC ID 136, 153, 158, 174, 184, and 185), failure modes not covered by the NASA FMEA baseline (MDAC ID 134 and 143), and various other differences (MDAC ID 127, 155, 170, 176, 177, 180, and 181).

The meeting with the NASA subsystem manager on 29 January 1987 resulted in seven issues which the subsystem manager felt should be considered by the APU FMEA/CIL review working group. These seven issues were failure modes of the fuel pump (MDAC ID 134 and

136), fuel line couplings (MDAC ID 153 and 158), fuel line filter (MDAC ID 174), and fuel pump seal cavity drain system (MDAC ID 178 and 183). The IOA recommended that failure modes be added for the fuel pump relief valve failing to relieve, for a leak in the seal cavity drain flex hose, and for an external leak from the seal cavity drain relief valve. The fuel pump relief valve failure mode was determined by the APU FMEA/CIL review working group to have no effect on the APU. The two seal cavity drain failure modes were incorporated into the NASA FMEA baseline of 24 July 1987.

The IOA recommended that redundancy screen A be passed for the fuel line quick-disconnect coupling, fuel pump filter, and fuel line filter failure modes, since the prelaunch APU run time constitutes checkout of the fuel filters for blockage, and the fuel couplings are capable of checkout by removing their caps. The APU FMEA/CIL review working group did not feel that the prelaunch run time constituted checkout of the fuel filters, and the NASA opinion concerning checkout of quick-disconnect couplings is that if the quick-disconnect itself is not leaking, then there is no way to verify that the cap will not leak. The IOA agrees with this reasoning.

4.3 Lube Oil Subsystem Assessment Results

During the initial assessment, thirty-eight lube oil system failure modes were compared to the Post 51-L NASA FMEA/CIL baseline which produced eighteen issues. These included external leaks from additional components (MDAC ID 195 and 215), failure modes for hardware items not specifically covered by the FMEAs (MDAC ID 188, 189, 203, 216, 217, 218, 219, 221, and 223), a higher criticality for lube oil heaters and thermostats failing off (MDAC ID 210, and 211), disagreements about redundancy screens (MDAC ID 199, 201, 204, and 214), and other differences (MDAC ID 194).

The meeting with the NASA subsystem manager on 29 January 1987 resulted in ten issues which the subsystem manager felt should be considered by the APU FMEA/CIL review working group. These ten issues were failure modes of the gearbox pressurization system (MDAC ID 188 and 195), gearbox oil service couplings (MDAC ID 199, 201, and 204), gearbox internal relief valves (MDAC ID 216, 218, and 219), and gearbox accumulators (MDAC ID 221 and 223). The IOA recommended individual FMEAs for external leaks from the gearbox GN2 bottle and the gearbox pressurization valve. The APU FMEA/CIL working group added these failures as additional causes to the existing FMEAs 04-2-MD19-2 and 04-2-GT11-2, respectively.

The IOA recommended an individual FMEA for failure of the lube oil filter bypass valve to relieve. This failure mode was incorporated into the NASA FMEA baseline of 24 July 1987. The IOA recommended individual FMEAs for the gearbox relief valve failing open and failing to relieve. The APU FMEA/CIL working group ascertained that failure of this valve in the open position would have no effect on the APU, so no additional FMEA was warranted. This is in accordance with the general NASA philosophy of considering the overall gearbox as one component, rather than attempting to write FMEAs for each component inside the gearbox.

The failure of the gearbox relief valve to relieve was judged not to be a credible cause for failure of the APU, so again no additional FMEA was warranted.

The IOA recommended FMEAs covering internal leaks in the two gearbox accumulators. The APU FMEA/CIL working group ascertained that these failure modes would have no effect on the APU, so no additional FMEAs were warranted.

The IOA recommended that the external leak failure modes for the gearbox fill, vent, and drain couplings be shown as passing redundancy screen A because the couplings are capable of checkout and show "NA" for Screen B because the cap can be considered standby redundancy. NASA reasoned that if the quick disconnect coupling itself is not leaking, then there is no way to ascertain whether or not the cap will leak, so Screen A is failed. The IOA accepts this reasoning. NASA also reasons that the quick disconnect is not a standby redundant item, and IOA accepts this reasoning.

During the assessment of the electrical FMEAs (Section 4.7), it was established that a lube oil heater stuck on may lead to loss of an APU. Thus, IOA feels that FMEA 04-2-S18A-2 should show criticality 3/1R, since the effect of it, in combination with a lube oil heater switch contact failed on, would be to cause a lube oil heater to be stuck on.

4.4 Gas Generator Injector Cooling Subsystem Assessment Results

The IOA analysis was based on the philosophy that loss of the injector cooling subsystem represented a 1/1 criticality, since APU hot restart would be required for a sudden deorbit soon after orbit insertion. This produced a large number of 1/1 and 2/1R failure modes.

The NASA FMEAs reflect the philosophy that the injector cooling subsystem is not needed for a normal flight, and that the situation described above, where it is needed, constitutes an intact abort. Therefore, the criticality for loss of the injector cooling subsystem is 3/3, but is 1/1 for intact aborts. The IOA agreed that this is the proper approach to follow in assigning criticalities to failure modes of the injector cooling subsystem.

The IOA analysis produced 23 failure modes for the gas generator injector cooling subsystem. The initial assessment between the IOA failure modes and the post 51-L NASA FMEA/CIL baseline produced no issues.

4.5 Fuel Pump/GGVM Cooling Subsystem Assessment Results

The IOA analysis was based on the philosophy that loss of the entire fuel pump/GGVM cooling subsystem represented a 1/1 criticality, since in this case the APUs might detonate if restarted for a sudden deorbit soon after orbit insertion. This produced a substantial number of 1/1, 2/1R, and 3/1R failure modes. The NASA FMEAs reflect the philosophy that this subsystem is not needed for a normal flight, and that the situation described above, where it is needed, constitutes an intact abort. Therefore, the criticality for loss of the entire fuel pump/GGVM cooling system is 3/3, but is 1/1 for intact aborts. The IOA agreed that this is the proper approach.

The IOA analysis produced 31 failure modes for the fuel pump/GGVM cooling subsystem. The initial assessment between the IOA failure modes and the post 51-L NASA FMEA/CIL baseline produced six issues, all involving failure modes not covered by the baseline FMEAs. These failure modes included external leakage from the water relief valve (MDAC ID 248), blockage at the water line filter (MDAC ID 261), leakage at the water line flex hose (MDAC ID 262), leakage into the water tank isolation valve solenoid (MDAC ID 266), and the fail open and fail closed modes of the water line check valve (MDAC ID 274 and 275).

The meeting with the NASA subsystem manager on 29 January 1987 resulted in all these issues being dropped, due to the overall lack of criticality of the fuel pump/GGVM cooling subsystem and to the fact that all the failure effects involved could be considered to be covered as part of the existing FMEAs.

4.6 Structure Subsystem Assessment Results

During the initial assessment, four structure failure modes were compared to the post 51-L NASA FMEA/CIL baseline, which produced two issues, both involving failure modes not covered by the baseline FMEAs. These failure modes were external leaks from the APU turbine housing (MDAC ID 276) and cracking of the APU turbine housing (MDAC ID 277).

The meeting with the NASA subsystem manager on 29 January 1987 resulted in these two issues being combined into one failure mode, leakage of the APU turbine housing. IOA recommended a criticality of 1/1, but the subsystem manager insisted on a criticality of 2/1R because the turbine housing is of two-walled construction. The resulting failure mode was incorporated into the NASA FMEA baseline of 24 July 1987.

4.7 Electrical Subsystem Assessment Results

The IOA analysis generated 114 failure modes for the electrical subsystem (84 original failure modes, plus 30 supplemental failure modes generated to match the revised CIL produced by the APU EPDC FMEA/CIL review working group). The APU EPDC FMEAs were completely re-done, to a greater level of detail, in the FMEA/CIL review working group meetings, but only the CIL items were available to the IOA for full review. The non-CIL items were assessed based on partial information (hardware item identification, failure mode, and criticality).

The initial assessment between the IOA baseline and the NASA APU EPDC CIL baseline of 10 July 1987 produced nine issues. These issues were provided to the APU EPDC FMEA/CIL review working group for consideration.

The IOA recommended a 3/3 criticality for failure modes resulting in lube oil heaters being stuck on (MDAC ID 361, 432X, and 433X), since this is the criticality shown in the hardware FMEAs for lube oil heaters and thermostats. The working group was aware of recent concerns that overheated lube oil might solidify on orbit and block lube oil circulation at a subsequent APU restart. These FMEAs will remain 2/1R pending the outcome of lube oil overheating tests. The hardware FMEAs should match the electrical FMEAs, of course, so APU hardware FMEA 04-2-S18A-2 should be set at criticality 3/1R, rather that 3/3. The IOA is showing this as a remaining outstanding IOA issue.

IOA recommended a criticality of 2/2 for open circuit failure of the gas generator/fuel pump power isolation diode. The working group correctly pointed out that two failures are required to cause loss of the redundant heaters for one APU, so the criticality stands as originally established, at 3/2R.

IOA recommended a new CIL covering the stuck on failure mode of the type IV hybrid driver in the gas generator heater power circuit, because it is criticality 3/1R and fails redundancy screen B (MDAC ID 439X). The working group pointed out that this is the thermostat driver and thus would be detectable if it failed on, since the heater would be on while the "heater on" command from the APU controller was absent. Thus it passes screen B and escapes the CIL. The IOA disagreed with the sequence of failures for the short circuit failure mode of the APU controller power circuit switch scan isolation diode (MDAC ID 429X) and claimed that the failure mode passes redundancy screen The working group called the control bus voltage difference that blows the fuses a second failure, rather than a pre-existing condition, meaning that the diode short has no immediate effect and is, therefore, not detectable. The IOA concurred with this reasoning. The IOA pointed out that a short circuit in the APU start circuit circulation pump inhibit circuit is of 1/1 criticality only in the event of an APU hot restart (i.e., an abort), so the criticality should be 3/3, with 1/1 for intact

abort. The working group felt it should keep this FMEA at a criticality of 1/1 to emphasize its importance.

The IOA assessed a criticality of 2/1R for the short circuit failure of the tank/fuel line heater power circuit switch scan isolation diode (MDAC ID 434X), based on considering a control bus voltage difference a pre-existing condition, rather than a related failure, and showing redundant heaters failed off as the effect. The working group considers the control bus voltage difference a related failure, and sets the criticality at 3/1R based on a failure sequence leading to a heater stuck on. IOA agrees with the NASA FMEA.

As a result of the APU EPDC FMEA/CIL review working group meetings, all nine issues were resolved.

4.8 Displays Subsystem Assessment Results

During the initial assessment, 10 display subsystem failure modes were compared to the post 51-L NASA FMEA/CIL baseline. This assessment produced no issues.

4.9 Instrumentation Subsystem Assessment Results

The IOA analysis consolidated all 3/3 instrumentation failure modes into one FMEA, as allowed by NSTS-22206, Rule 2.3.6.a. This is the reason for the large discrepancy in number of FMEAs between the IOA and NASA.

The IOA analysis generated 10 failure modes for this subsystem (4 original failure modes plus 6 supplemental failure modes). The initial assessment between the IOA failure modes and the post 51-L NASA FMEA/CIL baseline produced six issues, including the gas generator bed temperature sensor (MDAC ID 375) and several fuel line temperature sensors (MDAC ID 376, 377, 412X, 413X, and 417X).

The meeting with the NASA subsystem manager on 29 January 1987 resulted in one outstanding issue in this subsystem. The IOA had recommended a criticality of 3/1R for failure of the gas generator bed temperature sensor (MDAC ID 375), based on its importance in the APU logic. The subsystem manager pointed out that this sensor was to be removed from the APU start-up logic prior to the next flight. The IOA agreed with the NASA FMEA criticality of 3/3. The IOA showed failure modes of the fuel test line temperature sensors (MDAC ID 376 and 412X) and fuel pump seal cavity drain line temperature sensors (MDAC ID 377 and 413X) failing redundancy screen C, because redundant sensors were mounted on a common clamp. The subsystem manager pointed out that this design was to be changed to individual clamps prior to the next flight. IOA agreed with the NASA FMEA that screen C was passed.

IOA pointed out that no FMEAs existed covering failure of the fuel pump bypass line temperature sensors (MDAC ID 417X) which the IOA recommended at criticality 3/2R based on possible curtailment of orbit activities if insight into fuel line temperatures is lost. The subsystem manager agreed that this failure mode was not covered, but stated that consideration of APU instrumentation FMEAs had been deferred indefinitely to allow completion of the review of higher priority FMEAs. This remains as an IOA issue pending NASA review of the instrumentation FMEAs.

4.10 Controller Subsystem Assessment Issues

The IOA analysis produced 24 failure modes for the APU controller (22 original failure modes plus 2 supplemental failure modes). The initial assessment between the IOA failure modes and the post 51-L NASA FMEA/CIL baseline produced eight issues. One of these issues involved a disagreement on criticality (MDAC ID 385), and the rest involved failure modes not covered by the NASA FMEA baseline (MDAC ID 381, 386, 387, 391, 396, 397, and 399).

The meeting with the NASA subsystem manager on 29 January 1987 resulted in the resolution of all these issues. The IOA had recommended setting the criticality of a failed on output from the controller high speed control circuit at 2/1R, based on being one failure away from APU overspeed. The subsystem manager established that an APU overspeed was in actuality two failures away, confirming the NASA FMEA criticality of 3/1R.

With regard to the additional failure modes, the subsystem manager pointed out that the current philosophy of the NASA FMEAS was to include failures in controller outputs only and to exclude purely internal controller failures. He also stated that a comprehensive APU controller FMEA would eventually be developed. Thus, these seven issues were rejected. The additional failure modes included controller power supply failure (MDAC ID 381), APU start-up logic output fails off (MDAC ID 386), APU start-up logic output fails on (MDAC ID 387), gearbox pressure control output fails on (MDAC ID 391), APU start override logic output fails off (MDAC ID 396), APU start override logic output fails on (MDAC ID 397), and APU injector cooling command fails on (MDAC ID 399). The failure modes involving controller outputs can be considered covered as part of the existing FMEAs.

5.0 REFERENCES

Reference documentation available from NASA and Rockwell was used in the analysis. The documentation used included the following:

- 1. JSC-11174, Space Shuttle Systems Handbook, Rev. C., DCN-5, 9/13/85.
- 2. VS70-946099, Rockwell International Integrated System Schematic Orbiter OV099-APU, Rev. A09, 5/10/85.
- 3. JSC-18341, Mechanical Systems Console Handbook, Vol. II Systems Briefs Basic, Rev. A, PCN-3, 2/7/86.
- 4. JSC-08171, Space Shuttle Operations and Maintenance Requirements and Specification Document, V46 File III APU, 4/15/86.
- 5. JSC-12820, STS Operational Flight Rules Baseline, 9/1/87.
- 6. JSC-12770, Shuttle Flight Operations Manual, Vol. 9, Auxiliary Power Unit/Hydraulics Basic, 3/16/81.
- 7. APU/HYD TM 2101, APU?Hydraulics System Training Manual, 11/85.
- 8. V070-465XXX, Rockwell International APU Installation Drawings.
- 9. NSTS-22206, National Space Transportation System
 Instructions for Preparation of Failure Modes and Effects
 Analysis (FMEA) and Critical Items List (CIL), 10/10/86.
- 10. VS70-460109, Rockwell International Schematic Diagram Auxiliary Power Unit Subsystem, Rev. G, 1/27/87.
- 11. Rockwell specifications for APU:

a.	MC201-0001	Auxiliary Power Unit
b.	MC271-0080	Exhaust Duct
c.	MC282-0084	APU Subsystem Diaphragm Fuel Tank
d.	MC284-0431	H ₂ O Relief Valve
e.	MC286-0051	Füel Filter
f.	MC363-0025	Fuel Tank Electrical Heater
g.	MC363-0026	Fuel Line Electrical Heater
h.	MC363-0027	Oil Line Electrical Heater
i.	MC450-0017	Remote Power Controller
j.	Mc452-0147	Thermal Switch
k.	MC477-0261	150 Milliamp Hybrid Driver Controller
1.	MC477-0262	Time Delay Hybrid Driver
m.	MC477-0263	5 Amp Hybrid Driver Controller
n.	MC621-0038	Water Boiler Quick Disconnects
0.	ME271-0079	Medium and High Pressure Hydraulic
		Hose Assemblies
p.	ME271-0030	Servicing Coupling

q.	ME276-0032	Test Point Coupling
r.	ME282-0100	Positive Expulsion Tank
s.	ME284-0543	Drain Valve
t.	ME284-0544	Relief Valve
u.	ME284-0552	H ₂ O Solenoid Valve
v.	ME284-0558	Fuel Tank Valve
w.	ME360-0017	Snap Action Thermostat
	ME449-0150	Piezoelectric Accelerometer
v.	ME449-0160	Surface Temperature Sensor
-	ME449-0177	Low/Medium/High Range Pressure Transducer
aa.	ME449-0187	Tip Sensitive Temperature Sensor
	ME451-0018	Subminiature Fuse
	ME452-0102	Hermetically Sealed Toggle Switch

- 12. Sundstrand Aviation Drawings 7XXXXX.
- 13. RE-1882A, Sundstrand Aviation Failure Mode Effects Analysis of the Auxiliary Power Unit Model APU01, 7/19/76.
- 14. JSC Report M4001002, Auxiliary Power Unit Full Problem Record (FPR), 7/17/86.
- 15. MDAC IOA APU Working Paper 1.0-WP-VA86001-14, 12/12/86.
- 16. STS-82-0027, Orbiter Vehicle Operational Configuration Failure Mode Effects Analysis Auxiliary Power Unit Subsystem, Change 2, 1/28/83.
- 17. STS82-0033, Orbiter Vehicle Operational Configuration Failure Mode Effects Analysis Auxiliary Power Unit Subsystem Electrical Power Distribution and Control, 1/19/84.
- 18. APU FMEA/CIL Review Presentation of Results, 12/16/86.
- 19. APU Phase I FMEA/CIL/OMRSD CCB, 4/22/87.
- 20. APU EPDC CIL Review, 7/10/87.
- 21. APU FMEA/CIL Review Presentation of Results, 7/24/87.
- 22. APU FMEA/CIL Review Presentation of Results, 8/21/87.
- 23. Auxiliary Power Unit Subsystem (APUS) FMEA/CIL Review, Vol. I - Hardware, 10/2/87.
- 24. Auxiliary Power Unit Subsystem (APUS) FMEA/CIL Review, Vol. II - Electrical Power, Displays, and Control (EPD&C), 10/2/87.

APPENDIX A

AOA - Abort-Once-Around APU - Auxiliary Power Unit ATO - Abort-To-Orbit BITE - Built-In Test Equipment CCB - Change Control Board CIL - Critical Items List CRT - Cathode-Ray Tube DCN - Document Change Notice EGT - Exhaust Gas Temperature EPDC - Electrical Power, Distribution and Control - Fahrenheit, Functional FM - Failure Mode - Failure Modes and Effects Analysis **FMEA** FP - Fuel Pump FPR - Full Problem Record GFE - Government Furnished Equipment GG - Gas Generator GGVM - Gas Generator Valve Module GN2 - Gaseous Nitrogen - Water H20 HW - Hardware - Identification ID IOA - Independent Orbiter Assessment LCA - Load Controller Assembly MDAC - McDonnell Douglas Astronautics Company MDM - Multiplexer/Demultiplexer N2 - Nitrogen NA - Not Applicable - National Aeronautics and Space Administration NASA NH3 - Ammonia NSTS - National Space Transportation System - Operational Maintenance Requirements and OMRSD Specifications Document PCI - Potential Critical Item PCN - Page Change Notice psia - Pounds per Square Inch Absolute RTLS - Return-to-Launch Site STS - Space Transportation System STSEOS - Space Transportation System Engineering and Operations Support TAL - Transatlantic Abort Landing

- Water Spray Boiler

WSB

APPENDIX B

DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

- B.1 Definitions
- B.2 Project Level Ground Rules and AssumptionsB.3 Subsystem-Specific Ground Rules and Assumptions

APPENDIX B DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

B.1 Definitions

Definitions contained in <u>NSTS 22206</u>, <u>Instructions For Preparation of FMEA/CIL</u>, 10 October 1986, were used with the following amplifications and additions.

INTACT ABORT DEFINITIONS:

RTLS - begins at transition to OPS 6 and ends at transition
to OPS 9, post-flight

<u>TAL</u> - begins at declaration of the abort and ends at transition to OPS 9, post-flight

AOA - begins at declaration of the abort and ends at transition to OPS 9, post-flight

<u>ATO</u> - begins at declaration of the abort and ends at transition to OPS 9, post-flight

<u>CREDIBLE (CAUSE)</u> - an event that can be predicted or expected in anticipated operational environmental conditions. Excludes an event where multiple failures must first occur to result in environmental extremes

<u>CONTINGENCY CREW PROCEDURES</u> - procedures that are utilized beyond the standard malfunction procedures, pocket checklists, and cue cards

EARLY MISSION TERMINATION - termination of onorbit phase prior to planned end of mission

EFFECTS/RATIONALE - description of the case which generated the highest criticality

HIGHEST CRITICALITY - the highest functional criticality
determined in the phase-by-phase analysis

<u>MAJOR MODE (MM)</u> - major sub-mode of software operational sequence (OPS)

MC - Memory Configuration of Primary Avionics Software System
(PASS)

MISSION - assigned performance of a specific Orbiter flight with payload/objective accomplishments including orbit phasing and altitude (excludes secondary payloads such as GAS cans, middeck P/L, etc.)

<u>MULTIPLE ORDER FAILURE</u> - describes the failure due to a single cause or event of all units which perform a necessary (critical) function

<u>OFF-NOMINAL CREW PROCEDURES</u> - procedures that are utilized beyond the standard malfunction procedures, pocket checklists, and cue cards

OPS - software operational sequence

<u>PRIMARY MISSION OBJECTIVES</u> - worst case primary mission objectives are equal to mission objectives

PHASE DEFINITIONS:

PRELAUNCH PHASE - begins at launch count-down Orbiter
power-up and ends at moding to OPS Major Mode 102 (liftoff)

<u>LIFTOFF MISSION PHASE</u> - begins at SRB ignition (MM 102) and ends at transition out of OPS 1 (Synonymous with ASCENT)

ONORBIT PHASE - begins at transition to OPS 2 or OPS 8 and ends at transition out of OPS 2 or OPS 8

<u>DEORBIT PHASE</u> - begins at transition to OPS Major Mode 301 and ends at first main landing gear touchdown

<u>LANDING/SAFING PHASE</u> - begins at first main gear touchdown and ends with the completion of post-landing safing operations

APPENDIX B DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

B.2 IOA Project Level Ground Rules and Assumptions

The philosophy embodied in <u>NSTS 22206, Instructions for</u>
<u>Preparation of FMEA/CIL, 10 October 1986</u>, was employed with the following amplifications and additions.

1. The operational flight software is an accurate implementation of the Flight System Software Requirements (FSSRs).

RATIONALE: Software verification is out-of-scope of this task.

2. After liftoff, any parameter which is monitored by system management (SM) or which drives any part of the Caution and Warning System (C&W) will support passage of Redundancy Screen B for its corresponding hardware item.

RATIONALE: Analysis of on-board parameter availability and/or the actual monitoring by the crew is beyond the scope of this task.

3. Any data employed with flight software is assumed to be functional for the specific vehicle and specific mission being flown.

RATIONALE: Mission data verification is out-of-scope of this task.

4. All hardware (including firmware) is manufactured and assembled to the design specifications/drawings.

RATIONALE: Acceptance and verification testing is designed to detect and identify problems before the item is approved for use.

5. All Flight Data File crew procedures will be assumed performed as written, and will not include human error in their performance.

RATIONALE: Failures caused by human operational error are out-of-scope of this task.

6. All hardware analyses will, as a minimum, be performed at the level of analysis existent within NASA/Prime Contractor Orbiter FMEA/CILs, and will be permitted to go to greater hardware detail levels but not lesser.

RATIONALE: Comparison of IOA analysis results with other analyses requires that both analyses be performed to a comparable level of detail.

7. Verification that a telemetry parameter is actually monitored during AOS by ground-based personnel is not required.

RATIONALE: Analysis of mission-dependent telemetry availability and/or the actual monitoring of applicable data by ground-based personnel is beyond the scope of this task.

8. The determination of criticalities per phase is based on the worst case effect of a failure for the phase being analyzed. The failure can occur in the phase being analyzed or in any previous phase, whichever produces the worst case effects for the phase of interest.

RATIONALE: Assigning phase criticalities ensures a thorough and complete analysis.

9. Analysis of wire harnesses, cables, and electrical connectors to determine if FMEAs are warranted will not be performed nor FMEAs assessed.

RATIONALE: Analysis was substantially complete prior to NSTS 22206 ground rule redirection.

10. Analysis of welds or brazed joints that cannot be inspected will not be performed nor FMEAs assessed.

RATIONALE: Analysis was substantially complete prior to NSTS 22206 ground rule redirection.

11. Emergency system or hardware will include burst discs and will exclude the EMU Secondary Oxygen Pack (SOP), pressure relief valves and the landing gear pyrotechnics.

RATIONALE: Clarify definition of emergency systems to ensure consistency throughout IOA project.

APPENDIX B DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

B.3 APU-Specific Ground Rules and Assumptions

The IOA analysis was performed to the component or assembly level of the APU subsystem. The analysis considered the worst case effects of the hardware or functional failure on the subsystem, mission, and crew and vehicle safety.

1. The APU Controller was analyzed only to the functional level.

RATIONALE: This is in keeping with the NASA and Rockwell analyses, and is due to lack of adequate data, and resource and schedule constraints.

2. Couplings with caps were considered as one unit for analysis purposes.

RATIONALE: This simplified the analysis, and took into account the worst case failure (external leak).

3. Switches were analyzed as failing totally open or totally closed, regardless of the number of switch contacts. For multiposition switches, the analysis considered the worst-case position for failed-on cases.

RATIONALE: This simplified the analysis, and took into account the worst case failure (failure of all contacts is worse than failure of any one contact).

4. Fuel line temperature sensor failures were considered criticality 3/3, except in cases where fewer than 3 sensors were available to monitor the status of a particular fuel line heater.

RATIONALE: This was to avoid classifying all fuel line temperature sensor failures as 3/1R or greater, based on loss of detection of a failed-on heater.

5. The APU Fuel Pump/GGVM Cooling System and Gas Generator Injector Cooling System failures were assigned criticalities based on the effects of the failure during a flight situation where these cooling systems were required to be used.

RATIONALE: This approach considered the worst case effects of loss of a system - loss of that system under circumstances where use of the system is required.

APPENDIX C DETAILED ASSESSMENT

This section contains the IOA assessment worksheets generated during the assessment of this subsystem. The information on these worksheets facilitates the comparison of the NASA FMEA/CIL (Pre and Post 51-L) to the IOA detailed analysis worksheets included in Appendix E. Each of these worksheets identifies the NASA FMEA being assessed, corresponding MDAC Analysis Worksheet ID (Appendix E), hardware item, criticality, redundancy screens, and recommendations. For each failure mode, the highest assessed hardware and functional criticality is compared and discrepancies noted as "N" in the compare row under the column where the discrepancy occurred.

LEGEND FOR IOA ASSESSMENT WORKSHEETS

Hardware Criticalities:

- 1 = Loss of life or vehicle
- 2 = Loss of mission or next failure of any redundant item
 (like or unlike) could cause loss of life/vehicle
- 3 = All others

Functional Criticalities:

- 1R = Redundant hardware items (like or unlike) all of which,
 if failed, could cause loss of life or vehicle
- 2R = Redundant hardware items (like or unlike) all of which,
 if failed, could cause loss of mission

Redundancy Screens A, B and C:

P = Passed Screen F = Failed Screen NA = Not Applicable

NASA Data:

Baseline = NASA FMEA/CIL

New = Baseline with Proposed Post 51-L Changes

CIL Item :

X = Included in CIL

Compare Row:

N = Non compare for that column (deviation)

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LEAD AND	ALY	ST	:	J.	BAI	RN:	ES															
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REMARKS:	:												•	ΤN	ΑL	DEQUA	ATE:	L		J		

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SUBSYSTEM MDAC ID: ITEM:	1:		APU 104 EXHAU	ST 1	DUCT										
LEAD ANAI	LYST	;	J. BA	RNE	3										
ASSESSMEN	T:														
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COMPARE	[/]	[1	(]	[)		[]	
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SUBSYSTE MDAC ID: ITEM:	M:		APU 105 EXHAUS	ST	DUCT 1	BEL:	LOWS	;						
LEAD ANA	LYST	:	J. BAH	RNI	ES									
ASSESSME	NT:													
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	אטת	4/ F UI	NC		A		В			С				•
NASA IOA	[1	/1 /1]	[NA] NA]	[[NA]		[[NA] NA]		[X [X]	*
COMPARE	[/]	[]	[)		[]		[]	
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SUBSYST MDAC ID ITEM:			APU 106 GEARBO	Х								
LEAD AN	IALYS'	T:	J. BAI	RNES								
ASSESSM	ENT:											
		TICAL: FLIGH: DW/FUI	r	RI A	EDUND	ANCY B	SCRE		С		CIL	
NASA IOA	. [:	2 /1R 2 /1R]	[P]	[P]	נ נ	P] P]	[X	;] *
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REMARKS	:											

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	APU-107	NASA DATA BASELINE NEW	=
SUBSYSTEM: MDAC ID: ITEM:	APU 107 GAS GENERATOR BEI) HEATER	
LEAD ANALYST:	J. BARNES		
ASSESSMENT:			
CRITICAL: FLIGH	r		CIL ITEM
HDW/FU	NC A	ВС	
NASA [3 /3 IOA [3 /1R] [NA] [] [P] [NA] [NA] P] [P]	[] *
COMPARE [/N] [N] [и] [и]	[]
RECOMMENDATIONS:	(If different f	from NASA)	
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* CIL RETENTION I	RATIONALE: (If app	olicable) ADEQUATE INADEQUATE	
NASA HAS NEW TEST		S APU CAN BE STARTED PTS NASA CRITICALITY	

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/86 APU-108 04-2-HR13-11		NASA DATA: BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	APU 108 GAS GENERATO	R BED HEATER		
LEAD ANALYST:	J. BARNES			
ASSESSMENT:				
CRITICAL		NDANCY SCREEN	s	CIL
FLIGHT HDW/FUI		В	С	ITEM
NASA [3 /3 IOA [3 /3] [NA]] [NA]	[NA] [[NA] [NA] NA]	* []
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* CIL RETENTION I	RATIONALE: (I		ADEQUATE NADEQUATE	[]
REMARKS: NASA DID NOT LIST LOSS IS 3/3, IOA				SINCE HEATER

ASSESSMENT DATE: 1 ASSESSMENT ID: A NASA FMEA #: 0	•	NASA DATA: BASELINE [] NEW [X]
	APU LO9 GAS GENERATOR BED HEATER	
LEAD ANALYST: J	. BARNES	
ASSESSMENT:		
CRITICALIT FLIGHT HDW/FUNC		ITEM
NASA [3 /3] IOA [3 /1R]	[NA] [NA] [N [P] [P] [F	[] * []
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RECOMMENDATIONS:	(If different from NASA)	
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* CIL RETENTION RA		ADEQUATE [] ADEQUATE []
NASA HAS NEW TEST	DATA WHICH SHOWS APU CAN E R BED. IOA ACCEPTS NASA CR	

ASSESSMEN ASSESSMEN NASA FMEA	T ID):	APU-1	10		-1						ASA DATA BASELINE NEW]	
SUBSYSTEM MDAC ID: ITEM:	:		APU 110 GAS G	EN	ER#	ATOR	ВЕГ	H	EATE	R T	ГНЕ	ERMOSTAT			
LEAD ANAL	YST:		J. BA	RN	ES										
ASSESSMEN	T:														
C		CAL	CTY C		RI	EDUN	DANC	Y	SCRE	ENS	5		CIL	M	
	HDW	/FUI	1C		A			В			С				
NASA IOA	[3	/3 /1R]	[[NA P	A]	[NA P]	[NA P]	[]	*
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RECOMMEND	ATIC	NS:	(If	đ	ifi	fere	nt f	rc	m NA	SA))				
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REMARKS: NASA HAS	NEW	mesc	מידערו יו	w	HT(TH S	HOWS	: 2	PII C	ממי	RF	STARTE	D SA	тяя	у мттн
COLD GAS				_											

ASSESSME ASSESSME NASA FME	NT	ID:		-111		NASA DATA: BASELINE [] NEW [X]						
SUBSYSTE MDAC ID:			APU 111 GAS	11 AS GENERATOR BED HEATER THERMOSTAT					ŗ			
LEAD ANA	LYS'	T:	J. :	BARN	ES							
ASSESSME	NT:											
		TICAL FLIGH DW/FU	r		REDUN A		Y SCR B	EENS	c C	CII		
NASA IOA	[3 /3 3 /3]	[NA] NA]	[]	NA] NA]]	NA] NA]	[]. *]	
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* CIL RE	TEN'	TION 1	RATI(ONAL	E: (If	app:	licab	•	ADEQUATE IADEQUATE	[]	

REMARKS:

	12/10/86 APU-112 04-2-MPU1-	-11	NASA DATA: BASELINE [] NEW [X]							
MDAC ID:	APU 112 MAGNETIC 1	PICKUP UNI	т 1							
LEAD ANALYST:	J. BARNES									
ASSESSMENT:										
CRITICALI FLIGHT HDW/FUN	r	EDUNDANCY B	SCREENS C	CIL ITEM						
NASA [2 /1R IOA [2 /1R] [P] [P]] [P]] [P]	[X] *						
COMPARE [/] [] [] []	[]						
RECOMMENDATIONS:	(If dif	ferent fro	m NASA)							
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* CIL RETENTION I	RATIONALE:	(If appli		QUATE [X] QUATE []						

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SUBSYSTE MDAC ID:	M:		APU 113 MAG		: P	ICK	UP U	JNI	т 2			•					
LEAD ANA	LYS	T:	J.	BARNE	S												
ASSESSME	NT:																
		TICA FLIC IDW/I			RE A	DUN	DANC	ey B	SCRI	EENS	c				[L PEM	ſ	
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* CIL RE	TEN	TION	(RAT)	CONALE	E:	(If	apr	oli	cab]	-		EQUAT EQUAT		[x]	

IOA CONCURS WITH NASA ANALYSIS.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/86 APU-114 04-2-MPU3	-1		NASA DATA BASELINE NEW]
SUBSYSTEM: MDAC ID: ITEM:	APU 114 MAGNETIC	PICKUP U	NIT 3			
LEAD ANALYST:	J. BARNES					
ASSESSMENT:						
CRITICAL FLIGH HDW/FU	T	EDUNDANC		ens C	CIL	1
NASA [3 /1R IOA [3 /1R] [P] P]	[P] [P]	[] *
COMPARE [/] [) []	[]	C .]
RECOMMENDATIONS:	(If dif	ferent f	rom NAS	SA)		
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* CIL RETENTION	RATIONALE:	(If app	licable	adequate inadequate]]
REMARKS:					_	_

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SUBSYSTEMDAC ID:				AP 11 FU		Aì	1K									
LEAD ANA	LY	ST:	:	J.	BAR	NI	ES									
ASSESSME	ENT	:														
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RECOMMEN	IDA!	ric	ns:		(If	di	iffere	nt	fr	om N	ASA))				
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REMARKS:

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	APU-116		[x]		
SUBSYSTEM: MDAC ID: ITEM:	APU 116 FUEL TAN	ΝK			
LEAD ANALYST:	J. BARNI	ES			
ASSESSMENT:					
CRITICAI FLIGH		REDUNDAN	CY SCREEN	1S	CIL ITEM
HDW/FU	INC	A	В	С	
NASA [1 /1 IOA [1 /1] [NA] [NA] [NA] ([NA] [NA]	[X] * [X]
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RECOMMENDATIONS:	(If d	ifferent	from NASA	A)	•
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* CIL RETENTION REMARKS:	RATIONALI	E: (If ap) ADEQUATE INADEQUATE	[x]
IOA LISTED FUEL COVERED BOTH AS			AS SEPARI	ATE FAILURE	MODES. NASA

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:	: 12/10/8 APU-117 04-2-TK	6 :11 - 11	NASA DATA: BASELINE [] NEW [X]							
SUBSYSTEM:	APU 117 FUEL TA									
LEAD ANALYST:	J. BARN	ES								
ASSESSMENT:										
FLIG		REDUND A	ANCY SCRI	ens C	CIL ITEM					
NASA [1 /1 IOA [2 /1] [R] [NA] P]	[NA] [P]	[NA] [P]	[X] *					
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NASA DID NOT LI IOA ACCEPTS NAS			MODE SEPA	ARATELY FROM	I FUEL LEAK.					

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		-12		NASA DATA: BASELINE NEW	
MDAC ID:	APU 118 FUEL TANK				
LEAD ANALYST:	J. BARNES				
ASSESSMENT:					
CRITICAL FLIGH HDW/FU	T	EDUNDANCY B		c	CIL ITEM
NASA [2 /1R IOA [2 /1R] [P] [P] [P] P]	[X] * [X]
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RECOMMENDATIONS:	(If dif	ferent fr	om NASA)		
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* CIL RETENTION	RATIONALE:	(If appl		ADEQUATE IADEQUATE	[x]
REMARKS:					

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SUBSYSTE MDAC ID:					9	ΓAI	NK	GN2	2 L	IN]	E										
LEAD ANA	LY	ST	:	J.	BA	RN]	ES														
ASSESSME	NT	:																			
		F	ICALI LIGH W/FU	r			RI A	EDUN	IDA		Y : B	SCRE		s c				CI	CL CEN	1	
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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		NASA DATA: BASELINE [] NEW [X]								
MDAC ID:	APU 120 FUEL TANK GN	2 FILL COUPLING								
LEAD ANALYST:	J. BARNES									
ASSESSMENT:										
CRITICAL FLIGH		INDANCY SCREENS	CIL ITEM							
HDW/FU	NC A	. В С								
NASA [3 /1R IOA [2 /1R] [F]] [P]	[F] [P] [P]	[X] * [X]							
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ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:	: 12/10/86 APU-121 04-2-MD12-11	1	NASA DATA: BASELINE [] NEW [X]
SUBSYSTEM: MDAC ID: ITEM:	APU 121 FUEL TANK GN2	FILL COUPLING	3
LEAD ANALYST:	J. BARNES		
ASSESSMENT:			
CRITICA FLIG HDW/F	HT	DANCY SCREENS B	CIL ITEM
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* CIL RETENTION	RATIONALE: (If		ADEQUATE []

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SUBSYSTE MDAC ID: ITEM:	TANK	ISOLA	TION	VALVE	2						
LEAD ANA	LYST:	J. B.	ARNES								
ASSESSME	NT:										
	CRITICA FLIC HDW/1		RE A	DUNDA	NCY B	SCREEN	is C	CIL			
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* CIL RE	TENTIO	N RATIO	NALE:	(If a	ppli		ADEQUATE NADEQUATE]		
REMARKS:								•	•		

ASSESSMENT DATE: 12/10/86 ASSESSMENT ID: APU-123 NASA FMEA #: 04-2-LV11-12							NASA DATA: BASELINE [] NEW [X]										
SUBSYSTEM MDAC ID: ITEM:	C ID: 123													•			
LEAD ANALY	YST	:	J. BAF	NE	S												
ASSESSMEN'	T:																
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SUBSYSTEM: APU MDAC ID: 124 ITEM: FUEL T					ISOL	ATIO1	VAL	/E		•	
LEAD ANALYST: J. BARNES											
ASSESSME	NT:										
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REMARKS:											

ASSESSMENT DATE: ASSESSMENT ID:	12/10/86 APU-125		NASA DATA BASELINE	-
	04-2-LV11-10		NEW	[X]
	APU 125 FUEL TANK ISOL	ATION VALV	E	
LEAD ANALYST:	J. BARNES			
ASSESSMENT:				
CRITICALI FLIGHT		ANCY SCREE	ns	CIL ITEM
HDW/FUN		В	C	
NASA [1 /1 IOA [1 /1] [NA]] [NA]	[NA] [NA]	[NA] [NA]	[X] * [X]
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REMARKS:

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/86 APU-126 04-2-LV11-10		SA DATA: ASELINE [] NEW [X]
SUBSYSTEM: MDAC ID: ITEM:	APU 126 FUEL TANK ISOL	ATION VALVE	
LEAD ANALYST:	J. BARNES		
ASSESSMENT:			
CRITICALI FLIGHT HDW/FUI	r	ANCY SCREENS B C	CIL
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NASA FMEA #:	04-2-	·TATT-T	4		NEW	L	Х]	
SUBSYSTEM: MDAC ID: ITEM:	APU 127 FUEL	TANK I	SOLATIO	N VALVE					
LEAD ANALYST:	J. BA	RNES							
ASSESSMENT:									
CRITIC		RED	UNDANCY	SCREENS	5		IL		
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IOA CONCURS WITH NASA ANALYSIS.

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SUBSYSTEM MDAC ID:	M:		APU 128 FUEL	PUMI	·									
LEAD ANA	LYST:	ı	J. BAI	RNES	5									
ASSESSME	NT:													
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SUBSYSTE MDAC ID: ITEM:				AP 12 FU	9 EL PUMP														
LEAD ANA	LYS	ST	:	J.	BARN	ES													
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RECOMMEN	DAT	CIC	SNC:		(If d	if	fe	rent :	fr	om	NASA)							
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* CIL RE	TEN	IT:	ION 1	RAT	IONAL	E:	(If app) 1:	ica	ble)						_		
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REMARKS: IOA ACCE HAZARD A											EXTE:	RN	AL LE	AK]	s	CC	VE		IN

ASSESSME ASSESSME NASA FME	NT	II		AF	/10/ DU-13 -2-1	30		-11							ASA BASE	LI		[x]	
SUBSYSTE MDAC ID:				AF 13 FU		PUI	MP														
LEAD ANA	LYS	ST	:	J.	BAI	RN	ES														
ASSESSME	NT	:																			
		F	ICALI LIGHT	C	?		RI A	EDUN	IDA		Y B	SCRE	ENS	s C					[L PEM	1	
NASA IOA	[2 2	/1R /1R]		[P P]		[P P]	[P P]			[X X]	*
COMPARE	[/]		[]		[1	[]			[]	
RECOMMEN	DA'	ric	ons:		(If	d :	if:	fere	ent	: f	r	om NA	SA)							
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* CIL RE	TEI	NT:	ION 1	RAI	NOI	AL	E:	(If	: a	pp	11	icabl			DEQU DEQU			[]	

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/86 APU-131 04-2-PP11-1	.1	NASA DATA: BASELINE NEW	[x]
SUBSYSTEM: MDAC ID: ITEM:	APU 131 FUEL PUMP B	SYPASS VALVE			
LEAD ANALYST:	J. BARNES				
ASSESSMENT:					
CRITICAL: FLIGHT HDW/FUI	r	OUNDANCY SCREENS B	c c	CIL ITEM	[
NASA [2 /1R IOA [2 /1R] [P]	[P] [[P] [P] P]	x]] *
COMPARE [/] []	[] []	[]
RECOMMENDATIONS:	(If diffe	erent from NASA)	•	
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* CIL RETENTION I	RATIONALE: (ADEQUATE NADEQUATE	[]

NASA ANALYSIS DID NOT CONSIDER THIS ITEM SEPARATELY.

ASSESSMEN ASSESSMEN NASA FME	NT I	D:		32	3				ASA DATA BASELINE NEW]
SUBSYSTEM MDAC ID:	M:		APU 132 FUEL	PUMI	BYF	PASS V	ALVE				
LEAD ANA	LYSI	:	J. BA	RNES	;						
ASSESSME	NT:										
•	F	CICALI FLIGHT OW/FUN	ľ	F		DANCY B		ENS C		CIL	
NASA IOA	[2	/1R /1R]	[F)	[P]	[P]	[X	[] *
COMPARE	[/	1	[]	[]	[]	[]
RECOMMENI	DATI	ons:	(If	dif	fere	nt fr	om NA	SA)			
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* CIL RE	rent	NOI!	RATION	ALE:	(If	appl	icabl	A	DEQUATE DEQUATE]
REMARKS:									~~X~	L	

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/86 APU-133 04-2-PP11	11		NASA I BASEI	
SUBSYSTEM: MDAC ID: ITEM:	APU 133 FUEL PUMF	P RELI	EF VALVE	:	
LEAD ANALYST:	J. BARNES	;			
ASSESSMENT:					
CRITICAI FLIGH HDW/FU	IT		DANCY SCR	REENS	CIL ITEM
•			_	•	F 35 3 .L
NASA [2 /1F IOA [2 /1F	() [P	,]	[P] [P]	[P]	[X] * [X]
COMPARE [/] [1	[1	[]	[]
RECOMMENDATIONS:	(If dif	feren	t from N	(ASA)	
[/] []	[]	[]	[] (ADD/DELETE)
* CIL RETENTION REMARKS:	RATIONALE:	(If	applicab	le) ADEQUA INADEQUA	

NASA DOES NOT ANALYZE RELIEF VALVE AS A SEPARATE ITEM.

ASSESSMENT DATE: 1/1 ASSESSMENT ID: APU NASA FMEA #: NON	U-134 BASELINE	
SUBSYSTEM: APU MDAC ID: 134 ITEM: FUE		
LEAD ANALYST: J.	BARNES	
ASSESSMENT:		
CRITICALITY FLIGHT	REDUNDANCY SCREENS	CIL ITEM
HDW/FUNC	A B C	
NASA [/] IOA [3 /1R]	[] [] [] [P] [F] [P]	[] * [x]
COMPARE [N /N]		[N]
RECOMMENDATIONS: ((If different from NASA)	
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* CIL RETENTION RATI	IONALE: (If applicable) ADEQUATE INADEQUATE	[]
REMARKS:		
	NOT CONSIDER THIS FAILURE MODE, DUI IOA CONCURS.	UE TO LACK OF

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/86 APU-135 04-2-PP1				: [
SUBSYSTEM: MDAC ID: ITEM:	APU 135 FUEL PUM	P RELIEF	VALVE		
LEAD ANALYST:	J. BARNE	s			
ASSESSMENT:					
CRITICAL FLIGH	r ·		CY SCREEN		CIL ITEM
HDW/FU	NC 2	A	В	С	
NASA [2 /1R IOA [1 /1] []] [AN	P] [NA] [P] NA]	[X] * [X]
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RECOMMENDATIONS:	(If di	fferent 1	from NASA	.)	
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* CIL RETENTION	RATIONALE	: (If app	plicable)		
REMARKS:			I	ADEQUATE NADEQUATE	• •
NASA DOES NOT CO EXTERNAL LEAK OF					
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SUBSYSTEM MDAC ID:	M:		APU 136 FUEL	PUI	MP	FILT	ER										
LEAD ANA	LYS'	T:	J. BAI	RNI	ES												
ASSESSME	NT:																
(TICALI FLIGHT	<u>. </u>			EDUND			SCREE	ENS					(L CEM	ſ	
	H	DW/FUN	NC .		A			В			С						
NASA IOA		2 /1R 2 /1R]]	F P]	[P P]	[P P]]	X X]	*
COMPARE	[/]	[N]	[]	ĺ]		[]	
RECOMMENI	DAT:	ions:	(If	d:	if	feren	t f	ro	om NAS	A)							
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* CIL RET	ren:	TION F	RATION	ALI	Ε:	(If	app	li	icable	•		EQUA		[x]	
REMARKS:														٠		J	

	12/10/86 APU-137 04-2-FL12-	-12	NASA BASE	DATA: LINE [] NEW [X]
MDAC ID:	APU 137 FUEL PUMP	FILTER		
LEAD ANALYST:	J. BARNES			
ASSESSMENT:				
CRITICAL: FLIGHT HDW/FUI	r	EDUNDANCY :	SCREENS C	CIL ITEM
·				
NASA [2 /1R IOA [3 /1R] [F] [F] [P]] [P]	[X] * [X]
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RECOMMENDATIONS:	(If diff	ferent from	m NASA)	
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* CIL RETENTION I	RATIONALE:	(If applie	cable)	·
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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/86 APU-138 04-2-PP1	11-11	[x]						
SUBSYSTEM: MDAC ID:	APU 138	APU							
LEAD ANALYST:	J. BARNI	ES							
ASSESSMENT:									
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM									
	NC	A	В	С					
NASA [2 /1R IOA [1 /1] [P] [NA] [P] [NA] [P] NA]	[X] *				
COMPARE [N /N] [N] [N] [N]	[]				
RECOMMENDATIONS:	(If d	ifferent 1	from NASA)						
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* CIL RETENTION	RATIONALI	E: (If app	-	ADEQUATE NADEQUATE					
REMARKS: NASA DOES NOT ANALYZE FUEL PUMP DRAIN COUPLING AS SEPARATE ITEM. FUEL PUMP EXTERNAL LEAK IS 2/1R BY NASA ANALYSIS; IOA CALLS IT 1/1 PER NSTS 22206 SECT. 2.3.3.h. THIS DISCREPANCY IS RESOLVED IN ASSESSMENT #129, AND IS NOT CONSIDERED AN ISSUE FOR THIS									

ASSESSMENT.

NASA FMEA #: 04-2-LV12-2	NEW [X]
SUBSYSTEM: APU MDAC ID: 139 ITEM: PRIMARY FUEL VALVE	
LEAD ANALYST: J. BARNES	
ASSESSMENT:	
CRITICALITY REDUNDANCY S FLIGHT	SCREENS CIL ITEM
HDW/FUNC A B	С
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COMPARE [N /] [] [] [и] [и]
RECOMMENDATIONS: (If different from	m NASA)
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* CIL RETENTION RATIONALE: (If application REMARKS: IOA CONCURS WITH NASA ANALYSIS.	cable) ADEQUATE [X] INADEQUATE []

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SUBSYSTEM: MDAC ID: ITEM:	1	APU 140 PRIMARY	r FU	EL VA	LVE					
LEAD ANALYST	: J	. BARI	NES							
ASSESSMENT:										
F	ICALII LIGHT			DUNDA		SCREE			CIL ITE	
HD	W/FUNC		A		В			С		
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COMPARE [/]		[]	[1	[]	[]
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* CIL RETENT	ION RA	ATIONA	LE:	(If a	appli	icable		ADEQUATE ADEQUATE	[X]
REMARKS:									L	4

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/86 APU-141 04-2-LV12	-2	NASA DATA: BASELINE [] NEW [X]						
	APU 141 PRIMARY F	UEL VALVE	:						
LEAD ANALYST:	LEAD ANALYST: J. BARNES								
ASSESSMENT:									
CRITICAL: FLIGHT HDW/FUI	ľ	EDUNDANCY E		ns C	CIL ITEM				
NASA [2 /1R IOA [3 /1R] [P] [F]	[P] [P]	[X] *				
COMPARE [N /] [] []	[]	[N]				
RECOMMENDATIONS:	(If dif	ferent fr	om NAS	A)					
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* CIL RETENTION I	RATIONALE:	(If appl) ADEQUATE INADEQUATE	[x]				

IOA CONCURS WITH NASA ANALYSIS.

ASSESSME ASSESSME NASA FME	NT ID:	12/10/86 APU-142 04-2-LVI			NASA DATA BASELINE NEW			
SUBSYSTE MDAC ID:		APU 142 PRIMARY	FUEL V	ALVE				
LEAD ANALYST: J. BARNES								
ASSESSME	NT:							
·	CRITICAL FLIGH HDW/FU	T	REDUND A	ANCY SCRE	ENS C	CIL ITEM		
NASA IOA	[2 /1R [2 /1R] [P] P]	[P] [P]	[P] [P]	[X] *		
COMPARE	[/] []	[]	[]	[]		
RECOMMEN	DATIONS:	(If di	ifferen	t from NA	SA)			
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* CIL RE	TENTION	RATIONAL	E: (If	applicabl	e) ADEQUATE INADEQUATE	[X]		

ASSESSMENT DATE: 12/10/86 ASSESSMENT ID: APU-143 NASA FMEA #: 04-2-V12-13-1 SUBSYSTEM: APU						-1			NASA DA BASELI N		x]		
SUBSYSTI MDAC ID ITEM:				143	_	FUEI	Z VAL	VE						
LEAD AND	ALY	ST:	;	J.	BARN	ES								
ASSESSMI	ENT	:												
FLIGHT				REDU A	INDAN(CY SO	CREEN	s C		CIL ITEM				
NASA IOA			/1 /1		[NA]]	NA]	[NA] NA]]	X X]	*
COMPARE	[/	3	[]	[]	[1	[]	
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REMARKS:

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SUBSYSTEM: MDAC ID: ITEM:	APU 144 PRIMAR	RY FUEL V	ALVE			
LEAD ANALYST:	J. BAR	RNES				
ASSESSMENT:						
FI	CALITY LIGHT N/FUNC	REDUND	ANCY SCRE	ENS C	CIL	
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COMPARE [/]	[]	[]	[]	£ .]
RECOMMENDATIO	ons: (If	differen	t from NA	SA)		
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REMARKS:		-				

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:	APU-145	-2	1		: [[X]
SUBSYSTEM: MDAC ID: ITEM:	APU 145 SECONDARY	FUEL VAL	VE			
LEAD ANALYST:	J. BARNES	;				
ASSESSMENT:						
CRITICA FLIG HDW/F	HT	EDUNDANCY B	SCREENS	:	CIL	
NASA [2 /1 IOA [2 /1	R] [P R] [P	P [P] []	?]	[X] *]
COMPARE [/] [] [] []	[]
RECOMMENDATIONS	: (If dif	ferent fro	om NASA)			
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ASSESSMENT DATE: ASSESSMENT ID:			NASA DATA: BASELINE []								
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-	APU 146 SECONDARY F	TUEL VALVE									
LEAD ANALYST:	J. BARNES										
ASSESSMENT:											
CRITICAL FLIGH		OUNDANCY SCREE	ens	CIL ITEM							
HDW/FU		В	С	IIEM							
NASA [1 /1 IOA [3 /1R] [NA]	[NA] [P]	[NA] [P]	[X] *							
COMPARE [N /N] [N]	[N]	[N]	[N]							
RECOMMENDATIONS:	(If diffe	erent from NAS	SA)								
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* CIL RETENTION	RATIONALE: ((If applicable	ADEQUATE								
REMARKS: IOA CONCURS WITH	NASA ANALYS	sis.									

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SUBSYSTI MDAC ID ITEM:				API 14' SE	7	RY FU	EL V	ALVE						
LEAD AND	ALY	ST	:	J.	BARN	ES								
ASSESSMI	ENT	:												
		FI	CAI LIGH			REDU	NDAN	CY SCI	REENS	c		IL PEM		
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COMPARE	[/]	[]	ſ	.]	[]	[]	
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ASSESSME ASSESSME NASA FME	NT	II):	APU	APU-148 BASELI									[]			
SUBSYSTE MDAC ID: ITEM:				APU 148 SEC	3	ΆΙ	RY	FUEL	V	ΑĽ	VΕ						i		
LEAD ANA	LYS	T:	;	J.	BAF	IN	ES												
ASSESSME	NT:																		
		FI	CAL LIGH	r			RI	EDUND	AN	CY	SC	REENS					CL CEN	1	
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IOA CONC		V	HTIV	NAS	SA A	N	AL:	KSIS.											

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/86 APU-149 04-2-LV13-2	NASA DATA: BASELINE [] NEW [X]								
SUBSYSTEM: MDAC ID: ITEM:	APU 149 SECONDARY FUE	L VALVE								
LEAD ANALYST:	J. BARNES									
ASSESSMENT:										
CRITICAL: FLIGHT HDW/FUI	T	DANCY SCRE	CIL ITEM							
NASA [2 /1R IOA [2 /1R] [P]	[P]	[P]	[X] * [X]						
COMPARE [/		[]	[]							
RECOMMENDATIONS:	(If differe	nt from NA	.SA)							
. [/] []	[]	[]	[] ADD/DELETE						
* CIL RETENTION	RATIONALE: (If	applicabl	e) ADEQUATE INADEOUATE	[X]						

REMARKS:

ASSESSME ASSESSME NASA FME	NT	ID:	12/10 APU-1 04-2-	50	-13-1	L			NASA D BASEI		[x]	
SUBSYSTE MDAC ID:	M:		APU 150 SECON	DAR!	Y FUE	EL VA	LVE							
LEAD ANA	LYS	T:	J. BA	RNE	S									
ASSESSME	NT:													
	TICAL FLIGH DW/FU	IDANC:	y scr B		CIL ITEM									
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ASSESSME ASSESSME NASA FME	TИ	ID:	APU-		1		NASA DATA: BASELINE [] NEW [X]						
SUBSYSTE MDAC ID: ITEM:	M:		APU 151 FUEL	LINE	-UPS	STREA	M OF	TANK	: ISOL V	ALVES			
LEAD ANA	LYS	ST:	J. E	ARNES									
ASSESSME	NT:	;											
		TICAI FLIGH	T				Y SCR			CIL ITEM			
	F	IDW/FU	INC	A			В		С				
NASA IOA	[1 /1 1 /1]	[N [N	A] A]	[]	NA] NA]]	NA] NA]	[X] * [X]			
COMPARE	[/]	[]	[]	[]	[]			
RECOMMEN	DAI	CIONS:	(1	f dif	fere	ent f	rom N	(ASA					
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ASSESSME ASSESSME NASA FME	NT	II):	ΑP	/10/ U-15 -2-L	2				NASA DATA: BASELINE [] NEW [X]							
SUBSYSTE MDAC ID: ITEM:				AP 15 FU	2	I	IE-DOWI	NSTI	REAN	1 OF	TZ	ANK ISO	L V	ALV	ÆS	3	
LEAD ANA	LYS	ST	:	J.	BAR	NI	ES										
ASSESSME	NT:	:															
CRITICALITY REDUND FLIGHT HDW/FUNC A								DANG	CY S	SCREI	ENS	s c		CIL ITEM			
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COMPARE	[/]		[]	[•]	[3		[]	
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ASSESSME ASSESSME NASA FME	TN	I	D:	APU-	153	11.	-13	NASA DATA: BASELINE [] NEW [X]												
SUBSYSTE MDAC ID:				APU 153 FUEL	TAI	ΝK	ну	DRA	ZI	[N]	E FI	:LL (cot	PLI	NG					
LEAD ANA	LY	ST	:	J. B	ARN	ES														
ASSESSME	NT	:																		
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COMPARE	[N	/N]	[N	J		[N]	[N]			[]	
RECOMMEN	DA!	ric	ONS:	(I	f di	Ĺfí	fer	ent	f	ro	om N	(ASA								
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REMARKS: NASA ANA												NT T		EQU COU]	I] :OA	\
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ASSESSME													BASI]	
NASA FME	Α	#:		04-	-2-MD	11-	11							N]	EW	[Х]	
SUBSYSTE MDAC ID:				APU 154 FUE		NK :	нүг	ORA?	ZI	NE F	ILL	CC	OUPL:	ING					
LEAD ANA	LY	ST	:	J.	BARNI	ES													
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REMARKS:											_	F 145	znnK,	UAI.		L		ı	

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		13	NASA DATA: BASELINE [] NEW [X]						
MDAC ID:	APU 155 FUEL LINE	TEST POINT COUP	LING						
LEAD ANALYST:	J. BARNES								
ASSESSMENT:									
CRITICAL: FLIGHT		DUNDANCY SCREEN	S	CIL ITEM					
HDW/FU	IC A	В	С						
NASA [2 /1R IOA [1 /1] [F]] [F] [] [NA] [P] NA]	[X] * [X]					
COMPARE [N /N] [N]	ן נאן (n j	[]					
RECOMMENDATIONS:	(If diffe	erent from NASA)						
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* CIL RETENTION F	RATIONALE:		ADEQUATE NADEQUATE	• •					
REMARKS: IOA CONSIDERED COREDUNDANT TO COUR			~						

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/86 APU-156 04-2-TP11-11	L	NASA DATA: BASELINE [] NEW [X]								
SUBSYSTEM: MDAC ID: ITEM:	APU 156 FUEL LINE TE	EST POINT COUP	LING								
LEAD ANALYST:	J. BARNES										
ASSESSMENT:											
CRITICAL FLIGH HDW/FU	T	INDANCY SCREEN B	s C	CIL ITEM							
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* CIL RETENTION	RATIONALE: (1		ADEQUATE NADEQUATE	[]						
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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/86 APU-157 04-2-L1A-11	NASA DATA: BASELINE [] NEW [X]									
SUBSYSTEM: MDAC ID: ITEM:	APU 157 FUEL LINE FLEX	HOSE									
LEAD ANALYST:	J. BARNES										
ASSESSMENT:											
CRITICAL: FLIGH: HDW/FUI	r	ANCY SCREENS B		CIL ITEM							
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RECOMMENDATIONS:	(If differen	t from NASA)									
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* CIL RETENTION I	RATIONALE: (If a	Z.	DEQUATE	[X]							

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	APU-158		NASA DATA: BASELINE NEW										
	APU 158 FUEL LINE HIGH PO	OINT BLEED) COUPLING										
LEAD ANALYST:	J. BARNES												
ASSESSMENT:													
CRITICAL FLIGH		CY SCREENS	3	CIL									
HDW/FU		ITEM											
NASA [2 /1R IOA [1 /1] [F] [] [NA] [A B C [F] [F] [P] [NA] [NA]											
COMPARE [N /N] [N][и] [N]	[]									
RECOMMENDATIONS:	(If different	from NASA)											
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* CIL RETENTION	RATIONALE: (If app	plicable)	3 DECUME	r v 1									
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REMARKS: NASA CONSIDERS C AND CAP AS ONE U	AP REDUNDANT TO CO	OUPLING.	IOA CONSII	DERS COUPLIN									

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ASSESSMENT							BASELI]		
NASA FMEA #	; :	04-2-MI	D13-	·11				NI	EW	[Х]	
SUBSYSTEM: MDAC ID: ITEM:		APU 159 FUEL L	INE	HIGH	i PO	INT B	LEEI	O COUPLI	NG				
LEAD ANALYS	ST:	J. BARI	NES										
ASSESSMENT:	:												
CRI	TICAL	ITY	RE	DUND	ANC	Y SCRI	EENS	5		CI	L		
Н	FLIGHT IDW/FUI		A			В		С		II	'EM		
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RECOMMENDAT	CIONS:	(If o	diff	eren	t f	rom NA	ASA)	•					
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SUBSYSTER MDAC ID: ITEM: (11A,11B)				EL 1						312	1,3 1	lB,3	2 A	,32B)					
LEAD ANA	LYSI	? :	J.	BAF	INS	ES										•			
ASSESSMEI	NT:																		
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	HL	W/FUI	NC			A				В			С						
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COMPARE	[/N]	*	[]		[N]	[]		[]	
RECOMMENI	DATI	ONS:		(If	d:	ifi	ere	≥nt	1	fro	om 1	NASA)						
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IOA CONCU	JRS	WITH	NA	SA A	N	\L\	SIS	3.											

ASSESSME NASA FME	NT ID:	APU-1	•		BASELIN		
SUBSYSTE MDAC ID: ITEM: S21B, S3	OSTAT (S11A,	, SllE	3, S21A				
LEAD ANA	LYST:	J. BA	RNES				
ASSESSME	NT:						
	CRITICAL FLIGH		REDUN	DANCY SCR	EENS	CIL	
	HDW/FU	NC	A	В	С		
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COMPARE	[\N]	[]	[N]	[]	ĺ]
RECOMMEN	DATIONS:	(If	differe	nt from N	ASA)		
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SUBSYSTE MDAC ID: ITEM: S21B, S3				TANK	HEA	TER I	HERM	OST	AT (S11	A, S	311B,	. S21A
LEAD ANA	'TAR	T:	J. B	ARNES	;							
ASSESSME	ENT:											
	CRITICALITY FLIGHT HDW/FUNC					IDANCY E		EENS	c c		CIL ITEN	
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COMPARE	[/	1	[N]	[]	C	N]		C	3
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SUBSYSTE MDAC ID:			APU 163 FUE													
LEAD ANA	LYSI	:	J.	BARN	ES											
ASSESSME	NT:															
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	HD	W/FU	NC		A			В			С					
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COMPARE	[/N]	[]	[N]	[]		[]	
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REMARKS: IOA CONC	URS	WITH	NAS	A AN	ALY	SIS	•									

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SUBSYSTIMDAC ID: ITEM: (S16A,S)			L12A		4 EL I	•		HEATI A,S11I						212A,S2	12B	, s:	212	A,S21B,S36A,S3
LEAD AN	ALYS	T:	;	J.	BAF	ENE	ES										٠	
ASSESSMI	ENT:	:																
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	r	1114	V/FUI	NC			A			В			C					
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COMPARE	[/N]		[N]	[N]	Į		3	נ	N]	
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IOA CONCURS WITH NASA ANALYSIS.

ASSESSMENT DATE: 1 ASSESSMENT ID: A NASA FMEA #: 0	APU-165	NASA DATA: BASELINE [] NEW [X]
MDAC ID:	APU 165 FUEL LINE HEATER THERMOS S112B,S11A,S11B,S26A,S26	STAT SB,S212A,S212B,S21A,S21B,S36A,S3
LEAD ANALYST:	J. BARNES	
ASSESSMENT:		
CRITICALIT FLIGHT	1	ITEM
HDW/FUNC	C A B	С
NASA [2 /1R] IOA [3 /3]] [P] [P]] [NA] [NA]	[P] [X]* [NA] []
COMPARE [N /N]] [N] [N]	[N] [N]
RECOMMENDATIONS:	(If different from NAS	A)
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* CIL RETENTION RA	ATIONALE: (If applicable	ADEQUATE [X] INADEQUATE []
IOA CONCURS WITH N	NASA ANALYSIS.	

ASSESSME	ASSESSMENT DATE: 12/10/86 ASSESSMENT ID: APU-166 NASA FMEA #: 04-2-S14A-1 SUBSYSTEM: APU NDAC ID: 166																DAT ELIN NI	ΙE		-		
SUBSYSTE MDAC ID: ITEM: (S19A,S1				16 FU	66 JEL 1																34	В)
LEAD ANA	LY	ST	:	J.	BAI	RNI	ES															
ASSESSME	ENT	:																				
		F	ICAL: LIGH:	r					DAI	NC		sc	CREE	NS					CI			
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COMPARE	[/N]		[]		[N]		[3			[]]	
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ASSESSME	NT ID:	APU-16	7					BASELIN	E		1	
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a		3 DII										
SUBSYSTE	M:	APU										
MDAC ID:		167										
ITEM:		FUEL L	INE	HEATE	R	THERMO	ST	AT (REDUN	'DAN	T)		
(S19A.S1	9B.S14A.	S14B.S2	9A.S	329B.S	24	A.S241	3.S	39A,S39B,	S34	A . S	334	4B)
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LEAD ANA	LIST:	J. BAR	NES									
ASSESSME	NT:											
	CRITICAL	ITY	RE	EDUNDA	NC	Y SCRI	EN	S	C	ΙL		
	FLIGH	T							ľ	TEN	1	
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COMPARE	[N /N	1	[N	1	ſ	N]	ſ	N]	[N]	
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REMARKS:												
IOA CONC	URS WITH	NASA A	NALY	SIS.								

	12/10/86 APU-168 04-2-HR111-1	NASA DAT BASELII NI	
MDAC ID:	APU 168 FUEL PUMP SEAL	CAVITY DRAIN LINE I	HEATER
LEAD ANALYST:	J. BARNES		
ASSESSMENT:			
CRITICALI FLIGHT HDW/FUR	P	ANCY SCREENS B C	CIL ITEM
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COMPARE [/] []	[N] []	[]
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REMARKS:

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SUBSYST: MDAC ID ITEM: THERMOS	:				59 JEL 1											LINE .2B)	HE	ATE:	R		
LEAD AND	ALY	ST	:	J.	BAI	RN:	ES														
ASSESSM	ENT	:																			
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COMPARE	[/]		[]		[N]		[]		[]	
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ASSESSMENT DATE:	12/10/8	86		NASA DATA	-
ASSESSMENT ID:	APU-170	0		BASELINE	
ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	04-2-S	112A-2		NEW	[X]
SUBSYSTEM: MDAC ID:	APU 170 FUEL PU	UMP SEAL	CAVITY DE	RAIN LINE HE.	ATER
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LEAD ANALYST:	J. BARI	NES			
ASSESSMENT:					
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FLIGH'	r				ITEM
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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/86 APU-171 04-2-HR17	-11		NASA DATA BASELINI NEV	
SUBSYSTEM: MDAC ID: ITEM:	APU 171 FUEL PUMP	/VALVE	HEATER		
LEAD ANALYST:	J. BARNES				
ASSESSMENT:					
CRITICAL FLIGH HDW/FU	T		NCY SCRE	ENS C	CIL ITEM
NASA [3 /2R IOA [3 /1R]	[P] [NA]	[P] [P]	[] *
COMPARE [/N] [1	[N]	[]	[]
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IOA CONCURS WITH NASA ANALYSIS.

ASSESSMENT DATE: 12/10/86 ASSESSMENT ID: APU-172 NASA FMEA #: 04-2-S17A-1 SUBSYSTEM: APU MDAC ID: 172												N		A DAT SELIN NE	E	[x	-	
SUBSYSTEM MDAC ID: ITEM: (S17A,S17			172 FUEI						ΗE	ATEI	R TH	EF	SWC	STAT				
LEAD ANA	LYST	':	J. I	BAF	ENE	ES												
ASSESSME	T:																	
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SUBSYSTE	M:		APU											
MDAC ID:			173	r Driver	/T73 T	7272 FFT	רומות ב		MOCE	2 (T)				
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LEAD ANA	LYS	T:	J. 1	BARNES										
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REMARKS:														
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SUBSYSTEM MDAC ID: ITEM:	:		APU 174 FUEL	IN-	-L:	INE	FIL	TEI	R								
LEAD ANAL	YST:		J. BA	RN	ES												
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ASSESSME ASSESSME NASA FME	NT I	D:	APU-1	2/10/86 PU-175 4-2-L1-11					NASA DATA: BASELINE [NEW [X]	
SUBSYSTE MDAC ID: ITEM:			APU 175 FUEL	75 UEL IN-LINE FILTER																
LEAD ANA	LYST	:	J. B	ARNI	ES															
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	F	LIGH'				DUN	DAI	NC		SCR	EEN						L EM	1		
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COMPARE	£	/]	[N]	([N]	[N]			[N]		
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* CIL RE	TENT	ION 1	RATION	IALI	2:	(If	ar	op	li	cab	-		DEQU DEQU			[]		
REMARKS: IOA CONC	URS 1	итти	NASA	ANZ	ı t.v	STS														
	~ 4 \~	*****		15			•													

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:				NASA DATA BASELINE NEW					
MDAC ID:	APU 176 FUEL IN-	LINE FI	LTER						
LEAD ANALYST:	EAD ANALYST: J. BARNES								
ASSESSMENT:									
CRITICAL FLIGH HDW/FU	r		NCY SCREE	ns C	CIL ITEM				
nDw/ro			_	_					
NASA [3 /3 IOA [2 /1R] []	NA] P]	[NA] [F]	[NA] [P]	[
COMPARE [N /N	1 f 1	N]	[N]	[N]	[N]				
RECOMMENDATIONS:	(If di	fferent	from NAS	A)					
[/	ָז (נ ^י	3	[]	[] (A)	[] DD/DELETE)				
* CIL RETENTION	RATIONALE	: (If a) ADEQUATE INADEQUATE					
REMARKS: THIS FAILURE MOD COUPLING. IOA C	E HAS NO :	EFFECT, SA ANAL	DUE TO U	PSTREAM FIL	TER AT FILI				

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	APU-177	NASA DAT BASELIN NE									
	APU 177 SEAL CAVITY DRAI	IN LINE									
LEAD ANALYST:	J. BARNES										
ASSESSMENT:											
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM HDW/FUNC A B C											
NASA [1 /1 IOA [2 /1R] [P] [] [P]	[P] [P] [F]	[X] * [X]								
COMPARE [N /N] [] [[и] [и]	[]								
RECOMMENDATIONS:	(If different	from NASA)									
- [/] [] [[] ADD/DELETE)								
	RATIONALE: (If ag	oplicable) ADEQUATE INADEQUATE									
REMARKS: IOA CONCURS WITH LINE.	NASA ANALYSIS, I	OUE TO PRESENCE OF	FUEL VAPORS IN								

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	APU-178	-11		NASA DATA BASELINI NEV	
	APU 178 SEAL CAVI	TY DRA	IN FLEX	HOSE	
LEAD ANALYST:	J. BARNES		,		
ASSESSMENT:					
CRITICAL		EDUNDA	NCY SCRE	ENS	CIL ITEM
FLIGH HDW/FU	_	В	С	ITEM	
NASA [2 /1R IOA [2 /1R] [P]	[P] [F]	[P] [F]	[X] * [X]
COMPARE [/] []	[N]	[N]	[]
RECOMMENDATIONS:	(If dif	ferent	from NA	SA)	
[/] []	[]	[] ([ADD/DELETE)
* CIL RETENTION REMARKS:	RATIONALE:	(If a	ıpplicabl	e) ADEQUATE INADEQUATE	
IOA CONCURS WITH	NASA ANAL	YSIS.			

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/86 APU-179 NONE			NASA DATA: BASELINE NEW	[]
	APU 179 SEAL CAVIT	TY DRAIN I	LINE			
LEAD ANALYST:	J. BARNES					
ASSESSMENT:						
CRITICAL: FLIGHT		EDUNDANCY	SCREENS	3	CIL	7
HDW/FUI		В		С		
NASA [/ IOA [3 /1R] [] [P] [] [P] [P]	[.] *
COMPARE [N /N] [N] [N] [N]	[]
RECOMMENDATIONS:	(If diff	ferent fro	om NASA)	ı		
·	j' t] [] [·]	[D/DF] :LETE)
* CIL RETENTION I	RATIONALE:	(If appli	•	ADEQUATE NADEQUATE	[[]
REMARKS: NASA ANALYSIS DII	O NOT CONSI	IDER THIS	FAILURE	E MODE.		

IOA CONCURS WITH NASA ANALYSIS.

ASSESSMENT DATE:]	NASA DATA:				
ASSESSMENT ID: NASA FMEA #:	APU-180 04-2-RV02	-2		BASELINE NEW]	
MDAC ID:	APU 180 SEAL CAVI	ry drain 1	RELIEF V	ALVE				
LEAD ANALYST:	J. BARNES							
ASSESSMENT:								
CRITICAL FLIGH		EDUNDANCY	SCREENS		CI	L EM	1	
HDW/FU		В	(С		. 1214	,	
NASA [3 /1R IOA [2 /1R] [P] [P] [P] [P] P]	[x]	*
COMPARE [N /] [] [] []	[N]	
RECOMMENDATIONS:	(If dif:	ferent fr	om NASA)					
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* CIL RETENTION	RATIONALE:	(If appl		ADEQUATE ADEQUATE	[]	
REMARKS: IOA CONCURS WITH	NASA ANAL	YSIS.						

ASSESSMENT DATE: ASSESSMENT ID:	12/10/86 APU-181		NASA DATA: BASELINE []								
NASA FMEA #:	04-2-RV02	-2			(x]						
SUBSYSTEM: MDAC ID: ITEM:	APU 181 SEAL CAVI	TY DRAIN	RELIE	F VALVE							
LEAD ANALYST:	J. BARNES										
ASSESSMENT:											
CRITICAL FLIGH		EDUNDANC	Y SCREE	ens	CIL ITEM						
HDW/FU			В	С	liem						
NASA [3 /1R IOA [2 /1R] [P] [P] P]	[P] [P]	[] * [X]						
COMPARE [N /] [] []	[]	[N]						
RECOMMENDATIONS:	(If dif	ferent f	rom NAS	SA)							
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* CIL RETENTION :	RATIONALE:	(If app	licable	ADEQUATE INADEQUATE							
IOA CONCURS WITH	NASA ANAL	YSIS.									

ASSESSMENT I ASSESSMENT I NASA FMEA #:								ASA DA' BASELI N	NE	[[X]
SUBSYSTEM: MDAC ID: ITEM:		APU 182 SEAL C	CAVIT	ry dr <i>i</i>	AIN I	RELIE	F VA	LVE			
LEAD ANALYST	r:	J. BAF	RNES								
ASSESSMENT:											
1	rical: FLIGH: DW/FUI	r	RI A	EDUNDA	ANCY B	SCREI	ENS C			CIL ITEM	1
NASA [3	3 /1R 3 /1R]	[P]	[P]	[P]		[] *
COMPARE [/	1	[]	[]	[]		[]
RECOMMENDAT	IONS:	(If	difi	ferent	t fro	om NAS	SA)				
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* CIL RETENT	rion 1	RATION	ALE:	(If a	appl:	icable	A	DEQUAT]]
REMARKS:								-		-	-

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/11/88 APU-183 04-2-RV02-3	NASA DATA: BASELINE [] NEW [X]								
	APU 183 SEAL CAVITY	DRAIN RELIEF	VALVE							
LEAD ANALYST:	J. BARNES									
ASSESSMENT:										
CRITICALI FLIGHT HDW/FUN	י	UNDANCY SCREEN	s c	CIL ITEM						
NASA [3 /1R IOA [2 /1R] [P]	[P] [[F] [P] F]	[] *						
COMPARE [N /] []	[N]	N]	[N]						
RECOMMENDATIONS:	(If differ	rent from NASA)							
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* CIL RETENTION F	RATIONALE: (ADEQUATE NADEQUATE	[]						

IOA CONCURS WITH NASA ANALYSIS.

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ASSESSMEN			APU-1			,					E	BASE	LINE NEW]	
NASA FMEA	4 # :		04-2-	CTO	,1	_							MEM	Ļ	Λ	J	
SUBSYSTEM			APU														
MDAC ID:			184														
ITEM:			SEAL	CAV	TT.	Y DR	ΆŢ	N (CATC	н вс).TT	'LE					
LEAD ANAI	LYST	:	J. BA	RNE	S												
ASSESSMEN	YT:																
(CRIT	ICAL:	ITY		REI	DUND	AN	CY	SCR	EENS	;			C]	L		
	_	LIGH						_			_			IJ	E	1	
	HD	W/FU	NC		A			В			С						
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NASA IOA	[2	/1R	j	į	P	j	į	F	j	į	P	j		Ī	X	j	
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COMPARE	[/	1	L		J	L	N]	[]		L		J	
RECOMMENI		ONG.	/ T 4	: a:	££,	0205	.+	fr	om M	7 C 7 \							
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* CIL RET	ren t	ION I	RATION	IALE	:	(If	ar	1 0	icab	le)							
						•	_	•		•	ΑI	EQU	ATE	[X]	
										IN			ATE	[]	
REMARKS:																	
IOA CONCU	JRS	WITH	NASA	ANA	TTX:	STS.											

ASSESSME ASSESSME NASA FME	NT ID:	12/10 APU-1 04-2-	85	-1	NASA DATA: BASELINE [] NEW [X]					
SUBSYSTE MDAC ID:		APU 185 SEAL	CAVI	ry dr	AIN CATCI	H BOTTLE DRA	AIN VALVE			
LEAD ANA	LYST:	J. BA	RNES							
ASSESSME	NT:									
	CRITICAL FLIGH		RI	EDUND.	ANCY SCRI	EENS	CIL ITEM			
	HDW/FU	INC	A		В	С				
NASA IOA	[3 /1F [3 /1F	l]	[P [P]	[P] [F]	[P] [F]	[] * [X]			
COMPARE	[/]	[)	[и]	[N]	[N]			
RECOMMEN	DATIONS:	(If	dif	feren	t from N	ASA)				
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* CIL RE	TENTION	RATION	ALE:	(If	applicab	ADEQUATE	• •			
REMARKS:	יווסכ שדייו	I NASA	ANAT.	VSTS.		INADEQUATE	י ן			

ASSESSME ASSESSME NASA FME	NT ID:	12/10/86 APU-186 04-2-MV0			NASA DATA BASELINE NEV	
SUBSYSTE MDAC ID: ITEM:		APU 186 SEAL CAV	TITY DRA	LIN CATCH	BOTTLE DRAI	IN VALVE
LEAD ANA	LYST:	J. BARNE	2S			
ASSESSME	NT:					
	CRITICAL FLIGH HDW/FU	${f T}$	REDUNDA A	NCY SCRE	ENS C	CIL ITEM
NASA IOA	[3 /3 [3 /3] [NA] NA]	[NA] [NA]	[NA] [NA]	[] *
COMPARE	[/] []	[]	[]	[]
RECOMMEN	DATIONS:	(If di	fferent	from NA	SA)	
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* CIL RE	TENTION :	RATIONALE	E: (If a	applicabl	e) ADEQUATE INADEQUATE	[]
* /***********************************						

ASSESSMI ASSESSMI NASA FMI	ENT	I		A	PU-1	87		-11					N		DATA ELINE NEW	[x]	
SUBSYSTEMDAC ID:				AI 18 LU)I	L I	PUMP	ı					,					
LEAD ANA	LY	ST	:	J.	BAI	RN:	ES												
ASSESSME	ENT	:																	
	CR		ICAL LIGH		Z		RI	EDUN	DAN	CY	SC	REEI	IS				IL Fei	Л	
	1		W/FU	_			A			В			C	:		4.	r tot	1	
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COMPARE	[/]		[]	(]	[]		[]	
RECOMMEN	IDA!	ri	ons:		(If	đ:	if	fere	nt	fr	om 1	NASA	(۵						
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* CIL RE	TEI	T.	ION 1	RAI	'ION <i>I</i>	ΙLI	Ξ:	(If	ap	pl:	ical		A		ATE	[X]	
REMARKS:												1	. 14 LJ	DEQU	MIL	L		J	-

	1/11/88 APU-188 04-2-MD19	-2		NASA DATA BASELINE NEW		
SUBSYSTEM: MDAC ID: ITEM:	APU 188 GEARBOX G	N2 BOI	TLE			
LEAD ANALYST:	J. BARNES					
ASSESSMENT:						
CRITICAL: FLIGHT HDW/FUI	r		NCY SCRE	ENS C	CIL ITEM	
·			_	_		
NASA [3 /1R IOA [3 /1R] [P]	[P] [P]	[P] [P]	[] *	
COMPARE [/] []	[]	[]	[]	
RECOMMENDATIONS:	(If dif	ferent	from NA	SA)		
[/	J]	[]	[]	[] ADD/DELETE)
* CIL RETENTION I	RATIONALE:	(If a	pplicabl	e) ADEQUATE INADEQUATE		
REMARKS:				THYDEACHTE	L J	

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	APU-189	PU-189 BASELINE []								
SUBSYSTEM: MDAC ID: ITEM:	APU 189 GEARBOX	39 EARBOX GN2 BOTTLE								
LEAD ANALYST:	ANALYST: J. BARNES									
ASSESSMENT:										
CRITICAL FLIGH		REDUNDANG	CY SCREEN	is	CIL ITEM					
HDW/FUI		A	В	С						
NASA [/ IOA [1 /1] [] [NA] [] [NA] [NA]	[x] *					
COMPARE [N /N] [N] [и] [[N]	[N]					
RECOMMENDATIONS:	(If d	ifferent :	from NASA	A)						
. [/] [] [] [[] (A	[] · DD/DELETE)					
* CIL RETENTION 1	RATIONALI	E: (If app	•	ADEQUATE INADEQUATE						
REMARKS: NASA ANALYSIS DOT BE CONSIDERED CON			HIS ITEM.	THIS FAI	LURE MODE CAN					

	12/10/86 APU-190 04-2-MD19	-2	NASA DATA: BASELINE [] ·2 NEW [X]						
MDAC ID:	APU 190 GEARBOX GI	N2 BOTTLE	FILL COU	PLING					
LEAD ANALYST:	J. BARNES								
ASSESSMENT:									
CRITICAL FLIGH		CIL ITEM							
HDW/FU		В	C	:		•			
NASA [3 /2R IOA [3 /1R] [P] [P] [P] []	·]	[] * .			
COMPARE [/N) [] [] [J	[]			
RECOMMENDATIONS:	(If dif	ferent fro	om NASA)						
[/] [] [] [] · (A)	[DD/DE] :LETE)			
* CIL RETENTION	RATIONALE:	(If appl:	Į.	DEQUATE]			
REMARKS: IOA CONCURS WITH	NASA ANAL	ysis.							

ASSESSMI ASSESSMI NASA FMI	ENT	II):	APU	/10/8 J-191 -2-MD						A DATA SELINE NEW	[x]	
SUBSYSTIMDAC ID:				APO 191 GE	L	GN2	BOTT	LE F	'ILL	COUPL	ING		٠	
LEAD AND	ALY	ST	:	J.	BARN	ES								
ASSESSMI	ENT	:												
		Fl	LIGH	ITY T NC		REDI A	UNDAN	CY S	CREE	ns C		CI IT		
NASA IOA	[3	/3 /3]	[NA] NA]	[NA]		[NA] [NA]		[]	*
COMPARE	[/]	[)	[)		[]		[]	
RECOMMEN	VDA!	ric	ons:	((If d	iffe	rent	from	NAS	A)				
	ſ	•	/]	נ`	3	[]		[]	(A	[DD/] DELI	ETE)
* CIL RI	ETE	N T]	CON	RATI	ONALI	E: (If ap	plic		ADE	QUATE	[]	

REMARKS:

ASSESSMENT DATE: 12/10/86 ASSESSMENT ID: APU-192 NASA FMEA #: 04-2-LV14-1 NEW [X						
MDAC ID:	APU 192 GEARBOX P	RESSURI	ZATION V	ALVE		
LEAD ANALYST:	J. BARNES					
ASSESSMENT:						
CRITICAL FLIGH		EDUNDAN	CY SCREE	ens	CIL ITEM	
HDW/FU	NC A		В	С .		
NASA [3 /1R IOA [3 /1R] [F] [P] [F] P]	[P] [P]	[X] * [·]	
COMPARE [/] [N] [и ј	[]	[N]	
RECOMMENDATIONS:	(If dif	ferent	from NAS	SA)		
[/] [] [1		[] DD/DELETE	
* CIL RETENTION	RATIONALE:	(If ap	plicable	e) ADEQUATE INADEQUATE	[x]	
REMARKS: IOA CONCURS WITH	NASA ANAL	YSIS.				

ASSESSME ASSESSME NASA FME	NT I	D:	APU	'10/86 J-193 -2-LV1		NASA DATA: BASELINE [NEW [X] x]
SUBSYSTE MDAC ID: ITEM:			APU 193 GEA	3	PRESS	SURIZA	TION	VALV	E		
LEAD ANA	LYSI	C:	J.	BARNE	S						
ASSESSME	NT:										
	I	TICAL TLIGH	T			IDANCY	SCF			CII	_
)W/FU			A	В		С			
NASA IOA	[3	3 /3 3 /1R]	[]	P]	[P [P]	[P [P]	[] *
COMPARE	[/N]	[3	[]	[1	[1
RECOMMEN	DATI	ons:	([If di	ffere	ent fr	om N	NASA)			
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REMARKS:	URS	WITH	NAS	A ANA	LYSIS	· .					

ASSESSME ASSESSME NASA FME				ASA BASE	LINE		_						
SUBSYSTE MDAC ID:	M:		APU 194 GEARE	ox :	PRES	SURIZA	TION	VALV	E	*			
LEAD ANA	LYST	:	J. BA	RNE	S								
ASSESSME	NT:												
		ICAL:		:	REDU	NDANCY	SCR	REENS			CIL		
		W/FU			A	В		C					
NASA IOA	[3 [3	/3 /1R]	[P]	[P [P]	[P]		[] *]	
COMPARE	[/N]	[]	[]	[]		[3	
RECOMMEN	DATI	ons:	(If	di	ffer	ent fr	om N	IASA)					
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* CIL RE	TENT:	ION 1	RATION	IALE	: (I	f appl	icab	A	DEQU DEQU		_]	
REMARKS:	URS 1	WITH	NASA	ANA	LYSI	s.							

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/11/88 APU-195 04-2-GT11-2		nasa dat Baselin Ne	
SUBSYSTEM: MDAC ID: ITEM:	APU 195 GEARBOX PRESSU	JRIZATION	VALVE	
LEAD ANALYST:	J. BARNES			
ASSESSMENT:				
CRITICAL: FLIGH HDW/FUI	r	DANCY SCRE	ENS C	CIL ITEM
NASA [2 /1R IOA [2 /1R] [P] .	[P] [P]	[P] [P]	[X] * [X]
COMPARE [/] []	[]	[]	[]
RECOMMENDATIONS:	(If differen	nt from NA	SA)	
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* CIL RETENTION E	RATIONALE: (If	applicabl	e) ADEQUATE INADEOUATE	[]

REMARKS:

	12/10/86 APU-196 NONE		NASA DATA BASELINE NEW	
	APU 196 GEARBOX PRESS	URIZATION	VALVE	
LEAD ANALYST:	J. BARNES			
ASSESSMENT:				
CRITICAL FLIGH HDW/FU	T	IDANCY SCRE B	ENS C	CIL ITEM
11511/10	· · · · · · · · · · · · · · · · · · ·	2	C	
NASA [/ IOA [3 /3] []] [ER]	[] [F]	[] [P]	[] * []
COMPARE [N /N] [N]	[и]	[N]	[]
RECOMMENDATIONS:	(If differe	ent from NA	.SA)	
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* CIL RETENTION	RATIONALE: (If	applicabl	e) ADEQUATE	r ı
			INADEQUATE	
REMARKS: NASA ANALYSIS DI	D NOT COVER TH	IS FAILURE	MODE (BARRI	ER LEAK).
TOA CONCURS WITH	NASA ANALYSTS			

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/86 APU-197 04-2-L2-11	·	DATA: ELINE [] NEW [X]
SUBSYSTEM: MDAC ID: ITEM:	APU 197 LUBE OIL LIN	ES	
LEAD ANALYST:	J. BARNES		
ASSESSMENT:			
CRITICALI FLIGHT HDW/FUN	ŗ	ndancy screens B C	CIL ITEM
NASA [2 /1R IOA [2 /1R] [P]	[P] [P] [P]	[X] *
COMPARE [/] []	[] []	[]
RECOMMENDATIONS:	(If differ	ent from NASA)	
, 1], . []	[] []	[] (ADD/DELETE)
* CIL RETENTION F	RATIONALE: (I	f applicable) ADEQ INADEQ	

REMARKS:

ASSESSMENT ASSESSMENT NASA FMEA	'ID:	12/10/ APU-19 04-2-I	8	11				ASA DATA BASELINE NEW	[-
SUBSYSTEM: MDAC ID: ITEM:		APU 198 LUBE C	OIL I	LINE	FLEX	HOSES	5			
LEAD ANALY	ST:	J. BAF	ENES							
ASSESSMENT	!:									
	RITICALI FLIGHT HDW/FUN	נ	RE A	EDUND	ANCY B	SCREE	ens . C		CII	
NASA [] AOI	·		[P]	[P]	[P]	[}	(] * (]
COMPARE [/]	[]	[]	[]	[]
RECOMMENDA	TIONS:	(If	diff	feren	t fro	om NAS	SA)			
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* CIL RETE	NTION E	RATIONA	ALE:	(If	appli	icable	A	DEQUATE DEQUATE	[]	(]
REMARKS:								•	-	-

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	APU-199	L4 - 13		NASA DATA BASELINE NEW	
MDAC ID:	APU 199 GEARBOX	FILL CC	UPLING		
LEAD ANALYST:	J. BARNE	ES			
ASSESSMENT:					
CRITICAL FLIGH	T		NCY SCREI		CIL ITEM
HDW/FU	NC	A	В	С	
NASA [3 /1R IOA [2 /1R] [F] P]	[F] [P]	[P] [P]	[X] * [X]
COMPARE [N /] [N]	[N]	[]	[]
RECOMMENDATIONS:	(If di	fferent	from NAS	SA)	
[/] [1	[]	(A)	[] .DD/DELETE)
* CIL RETENTION	RATIONALE	E: (If a	pplicable	ADEQUATE INADEQUATE	
REMARKS: NASA ANALYSIS CON ANALYSIS CONSIDER					G. IOA

ASSESSME ASSESSME NASA FME	ENT	ID:	APU		-1				NASA BASE		[]	
SUBSYSTE MDAC ID:			APU 200 GEA		ILL	COUP	LING						
LEAD ANA	ALYS'	T:	J.	BARNES									
ASSESSME	ENT:												
		TICAL FLIGH DW/FU	T	R A			y scr B	EENS	c		CII	_	
NASA IOA	[:	3 /3 3 /3]	и] и]	A] A]	[]	NA] NA]	[NA] NA]		[] *	
COMPARE	[/]	[]	[]	[]		[]	
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	[/	1.	. []	t]	[,]	(A	[DD/I] DELETE	:)
* CIL RE	ETEN'	TION :	RATI	ONALE:	(If	app	licab	•	ADEQU IADEQU		[]	
REMARKS:	:												

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:				NASA DATA BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	APU 201 GEARBOX	HIGH PO	DINT VENT	COUPLING	
LEAD ANALYST:	J. BARN	ES			
ASSESSMENT:					
CRITICA FLIG HDW/F	łT	REDUNDA	NCY SCREE	ens C	CIL ITEM
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IOA [2 /1	R] [P j	[F] [P]	[P]	[X] * [X]
COMPARE [N /] [N]	[N]	[]	[]
RECOMMENDATIONS	(If d	ifferent	from NAS	SA)	
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* CIL RETENTION	RATIONAL	E: (If a	pplicable	ADEQUATE	[X]
REMARKS: NASA ANALYSIS C ANALYSIS CONSID					

APU-202		BASELINE	[]	
202	POINT VENT	COUPLING		
J. BARNES				
r IC A	В	С	CIL ITEM	
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	APU 202 GEARBOX HIGH I J. BARNES TY REDUNI C A [NA] [NA]] [] (If different	APU-202 04-2-MD14-1 APU 202 GEARBOX HIGH POINT VENT J. BARNES TY REDUNDANCY SCREE NC A B [NA] [NA] [NA] [NA]] [] [] (If different from NAS	APU-202 04-2-MD14-1 APU 202 GEARBOX HIGH POINT VENT COUPLING J. BARNES TY REDUNDANCY SCREENS NC A B C [NA] [NA] [NA]] [NA] [NA]] [NA] [NA]] [] [] [] (If different from NASA)] [] [] [] RATIONALE: (If applicable) ADEQUATE	APU-202 BASELINE [] 04-2-MD14-1 NEW [X] APU 202 GEARBOX HIGH POINT VENT COUPLING J. BARNES TY REDUNDANCY SCREENS CIL ITEM NC A B C [NA] [NA] [NA] [NA] []] [NA] [NA] [NA] []] [] [] [] (If different from NASA)] [] [] [] [] RATIONALE: (If applicable) ADEQUATE []

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	APU-203	l -11		NASA DA'I BASELIN NE	
SUBSYSTEM: MDAC ID: ITEM:	APU 203 GEARBOX C	CHIP DE	ETECTOR		
LEAD ANALYST:	J. BARNES	3			
ASSESSMENT:					
CRITICAI FLIGH		REDUNDA	NCY SCR	EENS	CIL ITEM
HDW/FU	INC A	1	В	С	
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ASSESSMENT ID: NASA FMEA #:			BASELINE NEW	[x]
MDAC ID:	APU 204 GEARBOX LOW P	OINT DRAIN C	OUPLING	
LEAD ANALYST:	J. BARNES			
ASSESSMENT:				
CRITICAL FLIGH		DANCY SCREEN	S	CIL ITEM
HDW/FU	NC A	В	C	
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SUBSYSTEM: MDAC ID: ITEM:	APU 205 GEARBOX	LOW POIN	T DRAIN C		•	·				
LEAD ANALYST:	J. BARN	ES								
ASSESSMENT:										
FL	CALITY IGHT /FUNC	REDUNDANO A	CY SCREEN	c c	CIL					
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ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:	APU-206			NASA DATA BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	APU 206 GEARBOX	HIGH PO	DINT DRAI	N COUPLING	
LEAD ANALYST:	J. BARN	ES			
ASSESSMENT:					
FLIC		REDUNDA	ANCY SCRE	ens	CIL ITEM
HDW/I	TUNC	Α .	В	С	
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REMARKS: NASA ANALYSIS (ANALYSIS CONSII					G. IOA

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SUBSYSTE MDAC ID:	M:		APU 207 GEAR	квох н	IGH	POIN'	r DRA	IN C	OUPLI	1G			
LEAD ANA	LYSI	?:	J. E	BARNES									
ASSESSME	NT:												
	F	CICAL LIGH W/FU	T	R A		I DANC	Y SCR B		С	·	CIL		
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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:								SA DA BASELI N	NE		_	
MDAC ID:	APU 208 WSB DRA	IN	COUPI	LING								
LEAD ANALYST:	J. BARN	ES										
ASSESSMENT:												
CRITICAL FLIGH HDW/FU	T	RE A	EDUNDA	NCY B	SCREI	ENS	c C			CIL		
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SUBSYSTEM: MDAC ID: ITEM:	APU 209 WSB DRA	IN COUP	LING		
LEAD ANALYST:	J. BARN	ES			
ASSESSMENT:					
FLI		REDUND.	ANCY SCRI	eens C	CIL ITEM
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COMPARE [N /	4] [N]	[N]	[N]	[]
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REMARKS: NASA ANALYSIS BOILER SYSTEM.	CONSIDERS	THIS IT	EM UNDER	HYDRAULIC/	WATER SPRAY

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		·11	NASA DATA BASELINE NEW					
MDAC ID:	APU 210 LUBE OIL I	INE HEATER	(18A, 18B, 19A	A, 19B)				
LEAD ANALYST:	J. BARNES							
ASSESSMENT:								
FLIGH'	r	DUNDANCY SC		CIL ITEM				
HDW/FU	NC A	В	3 C					
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REMARKS: IOA CONCURS WITH	NASA ANALY	sis.						

ASSESSMENT DATE	, ,			NASA DATA: BASELINE []							
ASSESSMENT ID: NASA FMEA #:	APU-211 04-2-S1		1		E		w [x]				
SUBSYSTEM: MDAC ID: ITEM:	APU 211 LUBE OI	[L L	STAT (S1	AT (S18A,S18B)							
LEAD ANALYST:	J. BARN	J. BARNES									
ASSESSMENT:											
CRITICA FLIG		RE	DUNDAN	CY SCI	REENS		CIL				
HDW/F	UNC	NC A			С						
NASA [3 /2 IOA [3 /1	R] [R] [[P] [P] NA]	[P [P]	[] *]			
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IOA CONCURS WIT	H NASA AN	VALY	sis.								

ASSESSMENT DATE: 1/28/8 ASSESSMENT ID: APU-21 NASA FMEA #: 04-2-S					A-2			NASA DA BASELI N		-		
SUBSYSTE MDAC ID: ITEM:	M:		APU 212 LUBE	OIL	LINE	неат	ER T	HERMOSTAT				
LEAD ANALYST: J. BARNES												
ASSESSMENT:												
	CRIT			I	REDUN	DANCY	SCR	EENS	CIL			
FLIGH HDW/FU			_			В		С	ITE	W		
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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/86 APU-213 04-2-FL13-11		NASA DATA BASELINE NEW	[]
SUBSYSTEM: MDAC ID: ITEM:	APU 213 LUBE OIL FILT	ER			
LEAD ANALYST:	J. BARNES				
ASSESSMENT:					
CRITICAL FLIGH HDW/FU	T	DANCY SCREE	ns C	CIL	1
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REMARKS:				-	→

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:				BASELINE NEW	[x]		
SUBSYSTEM: MDAC ID: ITEM:	APU 214 LUBE OIL	FILTE	R						
LEAD ANALYST:	J. BARNES	5							
ASSESSMENT:									
CRITICAL FLIGH HDW/FU	T ·	REDUNDA	ANCY S	CREENS C		CIL ITEM			
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IOA CONCURS WITH	NASA ANA	LYSIS.							

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:				A DATA: SELINE [NEW [x]			
SUBSYSTEM: MDAC ID:	APU 215 LUBE OIL							
LEAD ANALYST:	J. BARNE	s						
ASSESSMENT:								
CRITICAI FLIGH		REDUNDA	ANCY SC	REENS		CIL ITEM		
HDW/FU	_	A	В	C				
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ASSESSMENT DATE: 12/10/86						NASA DATA:										
ASSESSMEN NASA FMEA	APU-2	16)1-1					F	BASELINE NEW]			
SUBSYSTEM: APU MDAC ID: 216 ITEM: OIL FILTER BYPA								5 1	RELI	EF V	/AI		•		•	
LEAD ANALYST: J. BARNES																
ASSESSMEN	T:															
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ASSESSMENT I ASSESSMENT I NASA FMEA #	ID:	12/10/ APU-21 NONE						ASA DATA BASELINE NEW	[]	
SUBSYSTEM: MDAC ID: ITEM:		APU 217 OIL FI	LTER	R BYP	ASS I	RELIEF	' VA	LVE			
LEAD ANALYST: J. BARNES											
ASSESSMENT:											
	TICALI FLIGHT		REDUNDANCY SCREENS						CIL ITEM		
. H I	DW/FUN	ic	A		В		С				
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NASA DOES NOT CONSIDER THIS TO BE A CREDIBLE FAILURE MODE.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/11/88 APU-218 NONE		NASA DATA BASELINE NEW	-							
SUBSYSTEM: MDAC ID: ITEM:	APU 218 GEARBOX	BYPASS	LVE								
LEAD ANALYST:											
ASSESSMENT:											
CRITICAL FLIGH	T		NCY SCREE		CIL ITEM						
HDW/FU	NC	A	В	С							
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RECOMMENDATIONS:	(If di	fferent	from NAS	A)							
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OF CRITICALITY.

ASSESSMENT DATE: 1/11/88 ASSESSMENT ID: APU-219 NASA FMEA #: NONE NASA DATA: BASELINE [] NASA FMEA #: NONE NEW [X]	
SUBSYSTEM: APU MDAC ID: 219 ITEM: GEARBOX BYPASS RELIEF VALVE	
LEAD ANALYST: J. BARNES	
ASSESSMENT:	
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM	
HDW/FUNC A B C	
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COMPARE [N/N] [N] [N] [N]	
RECOMMENDATIONS: (If different from NASA)	
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INADEQUATE [] REMARKS:	
NASA ANALYSIS DOES NOT CONSIDER THIS ITEM, DUE TO LACK OF EFFE ON SYSTEM. IOA CONCURS.	₹C]

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SUBSYSTE MDAC ID: ITEM:	M:		AP 22 LU		L.	ACCU	JMU	LAT	OR	(ADD	- 0]	N)							
LEAD ANALYST: J. BARNES																			
ASSESSME	NT:																		
		TICAL FLIGH	T		R: A		IDA:	NCY B	sci	REEN	s c				CI IT	L	ſ		
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COMPARE	[/]	{]		[]	[]			[]		
RECOMMEN	DAT	'IONS:		(If d	lif	fere	ent	fr	om 1	NASA)								
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KLMAKKS:																			

NASA ANALYSIS DOES NOT CONSIDER THIS ITEM SEPARATELY.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/11/88 APU-221 NONE		BASELINE NEW	[x]
	APU 221 LUBE OIL	ACCUMULATOR (ADD-	-ON)	
LEAD ANALYST:	J. BARNES	s		
ASSESSMENT:				
CRITICAL: FLIGH		REDUNDANCY SCREENS		CIL ITEM
		A B	С	
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SUBSYSTEM MDAC ID:	M:			AF 22 LU	2)II	L 2	ACCT	U M U	LAT	OR	(INT	EGI	RAL)					
LEAD ANA	LYS	T:	:	J.	BAI	RN1	ES													
ASSESSME	NT:																			
(CRI		CAL LIGH				RI	EDUI	NDAI	NCY	SC	REEN	s			-	CII		ĺ	
	H	IDV	/FU	NC			A			В			С							
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REMARKS:	T.VS	:TS	s no	ES	мот	C	ועכ	ER '	THI	s I	ТЕМ	SEP	AR	ATE:	LY.		-		-	

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/11/88 APU-223 NONE	NASA DATA BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	APU 223 LUBE OIL ACCUMUL	ATOR (INTEGRAL)	
LEAD ANALYST:	J. BARNES		
ASSESSMENT:			
CRITICAL: FLIGH		CY SCREENS	CIL ITEM
HDW/FU		ВС	
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COMPARE [N /N] [N] [N] [N]	[N]
RECOMMENDATIONS:	(If different i	from NASA)	
.]] [][[] DD/DELETE)
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REMARKS:		INADEQUATE	
	ES NOT COVER THIS	ITEM, DUE TO LACK	OF EFFECT ON

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:	E: 12/10/8 APU-224 04-2-CI	•	NASA DATA: BASELINE [] NEW [X]				
SUBSYSTEM: MDAC ID: ITEM:	APU 224 INJECTO	R COOLING	VALVE				
LEAD ANALYST:	J. BARN	IES					
ASSESSMENT:							
CRITIC:		REDUNDAN	CY SCREEN	s	CIL ITEM		
HDW/		A	В	C			
NASA [3 /3 IOA [1 /3	B] [NA] [NA] [NA] [AN [NA] NA]	[
COMPARE [N /	7) (3 []	[N]		
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REMARKS: IOA ASSESSED CI REQUIRED.	RITICALITY	BASED ON					

IOA ACCEPTS NASA APPROACH.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/86 APU-225 04-2-CLV13-2		NASA DATA BASELINE NEW	[]
SUBSYSTEM: MDAC ID: ITEM:	APU 225 INJECTOR COO	LING VALVE		
LEAD ANALYST:	J. BARNES			
ASSESSMENT:				
CRITICAI FLIG		NDANCY SCRE	ENS	CIL ITEM
HDW/FU		В	С	11111
NASA [3 /3 IOA [1 /1] [NA]] [NA]		[NA] [NA]	[] * [X]
COMPARE [N /N] []	[]	[]	[N]
RECOMMENDATIONS:	(If differ	ent from NA	SA)	
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* CIL RETENTION	RATIONALE: (I	f applicabl	e) ADEQUATE INADEQUATE	[]
REMARKS: IOA ASSESSED CRI REQUIRED.	TICALITY BASE	D ON CONDIT	-	,

IOA ACCEPTS NASA APPROACH.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	APU-226		NASA DATA: BASELINE [] NEW [X]					
MDAC ID:	APU 226 INJECTO	R COOLI	NG VALVE					
LEAD ANALYST:	J. BARN	ES						
ASSESSMENT:								
CRITICAL FLIGH	T		ANCY SCRE		CIL ITEM			
HDW/FU	NC	A	В	С				
NASA [3 /3 IOA [2 /1R] [NA] P]	[NA] [P]	[NA] [P]	[x] *			
COMPARE [N /N] [n]	[N]	[N]	[N]			
RECOMMENDATIONS:	(If d	ifferen	t from NA	SA)				
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REMARKS: IOA ASSESSED CRI REQUIRED.	TICALITY	BASED	ON CONDIT	INADEQUATE				
IOA ACCEPTS NASA	APPROAC	н.						

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SUBSYSTI MDAC ID ITEM:				APU 227 INJI	ECTOR	c001	LING	VALVE	:				
LEAD AND	ALY	ST:	:	J. 1	BARNE	S							
ASSESSMI	TNE	:											
		FI	LIGH			REDUN	IDAN	CY SCR	EENS	S C	CII ITE		
		HDV	V/FU	NC		A		В		C			
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REMARKS:

	12/10/86 APU-228 04-2-CLV13	-2	NASA DATA BASELINE NEW	-
SUBSYSTEM: MDAC ID: ITEM:	APU 228 INJECTOR CO	OOLING VALVE		
LEAD ANALYST:	J. BARNES			
ASSESSMENT:				
CRITICAL FLIGH		OUNDANCY SCRE	ens	CIL ITEM
HDW/FU	NC A	В	С	
NASA [3 /3 IOA [2 /1R] [NA] [P] [NA]] [P]	[NA] [P]	[
COMPARE [N /N] [N]	ן א ן	[N]	[N]
RECOMMENDATIONS:	(If diffe	erent from NA	SA)	
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* CIL RETENTION	RATIONALE:	(If applicable	ADEQUATE	
REMARKS: IOA ASSESSED CRI REQUIRED.	TICALITY BAS	SED ON CONDIT	INADEQUATE	-

IOA ACCEPTS NASA APPROACH.

ASSESSMENT DATE: 12/10/86 ASSESSMENT ID: APU-229 NASA FMEA #: 04-2-CTK01-2									NASA D BASEL		[
SUBSYSTE MDAC ID:				API 229 IN	9	R C001	LING	WATER	R TAN	ıĸ					
LEAD ANA	LY	ST	:	J.	BARN	ES									
ASSESSME	'nТ	:													
	CR		ICAL LIGH			REDUI	ONADN	CY SCR	REENS	;			IL CEM	1	
		HD	W/FU	NC		A		В		С					
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RECOMMEN	DA'	TI	ons:		(If d	iffere	ent f	rom N	IASA)						
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DEMARKS.										ADEQUA'		[]	
REMARKS: IOA ASSE REQUIRED	SS	ED	CRI	TIC	ALITY	BASEI	ОО	CONDI	TION	S WHER	E CC	ю	ΊΝ	īG	IS
IOA ACCE	PT	S	NASA	API	PROACI	н.									

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LEAD ANA	LYS:	r:	J.	BARNES	S									
ASSESSME	NT:													
•	1	rical FLIGH DW/FU	r			IDANC	Y SCR	EENS	c		CI	L	Į.	
NASA IOA	[:	3 /3]]	[]	NA] NA]]	NA] NA]	[NA] NA]		[]	*
COMPARE	[/]	[)	[]	[1		[]	
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* CIL RE	TENT	rion :	RATI	ONALE	: (İf	app	olicab	-	ADEQUA IADEQUA		[]	

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/86 APU-231 04-2-CGC01	1		NASA DATA BASELINE NEW	=
SUBSYSTEM: MDAC ID: ITEM:	APU 231 INJECTOR C	COOLING	GN2 FILL	COUPLING	
LEAD ANALYST:	J. BARNES				
ASSESSMENT:					
CRITICAI FLIGH HDW/FU	T		Y SCREENS B	5 C	CIL ITEM
NASA [1 /1 IOA [1 /1] [NA] [NA	v] [NA] [NA] [NA] NA]	[X] *
COMPARE [/] [] [] [3	[]
RECOMMENDATIONS:	(If diff	erent f	rom NASA)		
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* CIL RETENTION	RATIONALE:	(If app	-	ADEQUATE NADEQUATE	[X]

REMARKS:

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/86 APU-232 NONE	5		NASA DATA: BASELINE NEW		
SUBSYSTEM: MDAC ID: ITEM:	APU 232 INJECTOR	R COOLIN	G GN2 FILL	COUPLING		
LEAD ANALYST:	J. BARNI	ES				
ASSESSMENT:						
CRITICAL: FLIGH		REDUNDA	NCY SCREEN	s	CIL ITEM	
HDW/FU		A	В	С		
NASA [/ IOA [3 /3] [] NA]	[] [[NA]	NA]	[] *	
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RECOMMENDATIONS:	(If d	ifferent	from NASA	.)		
[/] []	[] [[] DD/DELETI	E)
* CIL RETENTION 1	RATIONALI	E: (If a		ADEQUATE NADEQUATE		
REMARKS: NASA ANALYSIS DO	ES NOT CO	ONSIDER			-	ED).
NO ISSUE, DUE TO	LACK OF	SYSTEM	IMPACT.			

ASSESSMENT DATE: 1 ASSESSMENT ID: A NASA FMEA #: 0		NASA DATA BASELINE NEW	[]
SUBSYSTEM: A MDAC ID: 2	APU 233 INJECTOR COOLING WATER 1	LINES (MANIF	OLD)
LEAD ANALYST: J	J. BARNES		
ASSESSMENT:			
CRITICALIT FLIGHT	TY REDUNDANCY SCREE	ens	CIL ITEM
HDW/FUNC	C A B	С	
NASA [3 /3] IOA [1 /1]] [NA] [NA]] [NA] [NA]	[NA] [NA]	[x] *
COMPARE [N /N]] []	[]	[N]
RECOMMENDATIONS:	(If different from NAS	SA)	
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* CIL RETENTION RA	ATIONALE: (If applicable	a) ADEQUATE	[]
REMARKS:		- -	i i
	ICALITY BASED ON CONDITI	ONS WHERE CO	OOLING IS
IOA ACCEPTS NASA A	APPROACH.		

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:	APU-234	12/10/86 NASA DATA: APU-234 BASELINE [04-2-CL03-2 NEW [X							
SUBSYSTEM: MDAC ID: ITEM:	APU 234 INJECTOR	COOLING	WATER LI	NES (MANIF	OLD)				
LEAD ANALYST:	J. BARNE	S							
ASSESSMENT:									
CRITICA FLIG		REDUNDANG	CY SCREEN	S	CIL ITEM				
HDW/F	UNC	A	В	С					
NASA [3 /3 IOA [1 /1			NA] [AN [NA] NA]	[x] *				
COMPARE [N /N) [] [] [3	[N]				
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* CIL RETENTION	RATIONALE	: (If app	·	ADEQUATE VADEQUATE	[]				
REMARKS: IOA ASSESSED CR REQUIRED.	ITICALITY	BASED ON		~	OOLING IS				

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:	APU-235		DATA: LINE [] NEW [X]
SUBSYSTEM: MDAC ID: ITEM:	APU 235 INJECTOR COOL:	ING WATER FILL COU	PLING
LEAD ANALYST:	J. BARNES		
ASSESSMENT:			
CRITICA FLIG HDW/F	HT	DANCY SCREENS B C	CIL ITEM
•			(X 1 *
IOA [1 /1] [NA]	[NA] [NA] [NA]	[X] * [X]
COMPARE [/] []	[] []	[]
RECOMMENDATIONS	: (If differe	nt from NASA)	
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* CIL RETENTION	RATIONALE: (If	applicable) ADEQU	• •

REMARKS:

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/86 APU-236 NONE		NASA DATA BASELINE NEW	
	APU 236 INJECTOR COOLI	ING WATER	FILL COUPLIN	i G
LEAD ANALYST:	J. BARNES			
ASSESSMENT:				
CRITICAL: FLIGHT	ITY REDUND	ANCY SCRE	ENS	CIL ITEM
HDW/FUI		В	С	TIEM
NASA [/ IOA [3 /3] []] [NA]	[NA]	[NA]	[] *
COMPARE [N /N] [N]	[N]	[N]	[]
RECOMMENDATIONS:	(If differen	t from NAS	SA)	, •
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* CIL RETENTION F	RATIONALE: (If	applicable	e) ADEQUATE INADEQUATE	[]
REMARKS: NASA ANALYSIS DOI	ES NOT CONSIDER	THIS FAI	LURE MODE.	
NO ISSUE. DUE TO	LACK OF SYSTEM	TMPACT.		

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SUBSYSTE	M:			APU														
MDAC ID:				237														
ITEM:				INJE	СТО	R	COOI	LING	W	ATER	LI	NE-	-APU	X				
LEAD ANA	LYS	ST	:	J. B	ARN	ES												
ASSESSME	NT	:																
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COMPARE	г	N	/N	1	r	N	1	r	N	7	r	N	1		r	N	1	
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REMARKS:																		
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ASSESSMENT DATE:			NASA DATA:		
ASSESSMENT ID:			BASELINE	_]
NASA FMEA #:	04-2-CL03-2		NEW	[X]
-	APU 238 INJECTOR COOL	ING WATER LIN	E-APU X		
LEAD ANALYST:	J. BARNES				
ASSESSMENT:					
CRITICAL: FLIGH		DANCY SCREENS	, •	CIL	ver
HDW/FU	_	В	С	TIE	1
NASA [3 /3	ı rnaı	I NAI I	NAI	Г	1 *
IOA [2 /1R] [NA]] [P]	[P] [F]	[x	j
COMPARE [N /N] [N]	[N]	N]	[N]
RECOMMENDATIONS:	(If differe	nt from NASA)			
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* CIL RETENTION	DAMIONATE: /Tf	annlicable)			
* CIL RETENTION	RATIONALE: (II		ADEQUATE IADEQUATE	[]
REMARKS: NASA ANALYSIS DO	ES NOT CONSIDE				
IOA ACCEPTS NASA	APPROACH.				

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	APU-239										
SUBSYSTEM: MDAC ID: ITEM:	APU 239 INJECTOR (COOLING WATER	LINE FLEX HO	SE							
LEAD ANALYST:	J. BARNES										
ASSESSMENT:											
CRITICAL FLIGH HDW/FU	T	EDUNDANCY SCRE B	ENS C	CIL ITEM							
NASA [1 /1 IOA [2 /1R] [N?] [P	A] [NA]] [P]	[NA] [F]	[X] * [X]							
COMPARE [N /N] [n] [и]	[N]	[]							
RECOMMENDATIONS:	(If diff	ferent from NA	SA)								
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* CIL RETENTION : REMARKS: IOA ACCEPTS NASA		(If applicabl	e) ADEQUATE INADEQUATE	[]							

ASSESSME ASSESSME NASA FME	NT :	ID:	ΑI	2/10/ 2U-24 1-2-0	40		L - 2						ASA DA' BASELII N	NE]	
SUBSYSTE MDAC ID: ITEM:	M:		AI 24 IN	10	ro:	R (COOL	ING	WA	TER 1	ΓAΊ	١K	HEATE	R			
LEAD ANA	LYS'	r:	J.	. BAI	RN:	ES											
ASSESSME	NT:																
		rical Fligh		ľ		RI	EDUN	DANC	CY	SCREI	ENS	3			CIL		,
	H	DW/FU	NC			A			В			С					
NASA IOA	[:	3 /3 3 /1R]		[NA P	A]	[NA NA	.] .]	[NA P	A]]		[]	*
COMPARE	[/N]		[N]	[]	[N]		[]	
RECOMMEN	DAT:	ions:		(If	d :	ifi	fere	nt 1	fro	m NAS	SA))					
	[/] -		[3	[]	[]	(AI	[DD/D) ELF	ETE)
* CIL RE	TEN	rion	RAT	CION	AL	E:	(If	app	pli	cable	≘)						
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REMARKS: IOA ASSE REQUIRED		D CRI	TIC	CALI	ΓY	BA	ASED	ON	CO	NDIT	[O]	15	WHERE	CC	OOLI	NG	IS
IOA ACCE	PTS	NASA	AI	PPRO	AC	H.											

	12/10/86 APU-241 04-2-CS01-2		NASA DATA: BASELINE NEW	[] [x]
MDAC ID:	APU 241 INJECTOR COOLI	NG WATER TAI	NK HEATER T	THERMOSTAT
LEAD ANALYST:	J. BARNES			
ASSESSMENT:				
CRITICALI FLIGHT		ANCY SCREENS		CIL ITEM
HDW/FUN		В	С	
NASA [3 /3 IOA [3 /1R] [NA]] [P]	[NA] [NA] [NA] P]	[] *
COMPARE [/N] [N]	[] [N]	[]
RECOMMENDATIONS:	(If differen	t from NASA))	
[/] [.]	[] [[] DD/DELETE)
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REMARKS: IOA ASSESSED CRIT REQUIRED.	CICALITY BASED	ON CONDITION	IS WHERE CO	OLING IS

ASSESSME ASSESSME NASA FME	NT :	ID:	12/10 APU-2 04-2	242	1				NASA DA BASEL	INE			
SUBSYSTEMDAC ID:	M:		APU 242 INJE	CTOR	COOI	ING 1	WATER	TAN	K HEAT	ER 1	THEF	Mosi	TAT
LEAD ANA	LYS	r:	J. B	ARNES	3								
ASSESSME	NT:												
	1	TICAL: FLIGH: DW/FUI	r	F			Y SCR B		c		CII		
NASA IOA	[:	3 /3 3 /3]	[N	IA] IA]	[]	NA] NA]	[NA] NA]		[] ;	k
COMPARE	[/	3	[]	[1	[]		[1	
RECOMMEN	DAT:	ions:	(I:	f dif	fere	ent f	rom N	ASA)					
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ASSESSMENT DATE: ASSESSMENT ID:	12/10/86 APU-243		IASA DATA: BASELINE []	
NASA FMEA #:			NEW [X]	
	APU 243	LING WATER LINE	: HEATER	
LEAD ANALYST:	J. BARNES			
ASSESSMENT:				
CRITICAL: FLIGHT HDW/FUI	r	NDANCY SCREENS B C	CIL ITEM	
NASA [3 /3 IOA [3 /1R] [NA]] [P]	[NA] [N [NA] [P	[A] [] *	
COMPARE [/N] [N]	[] [N	נ ז ני	
RECOMMENDATIONS:	(If differe	ent from NASA)		
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* CIL RETENTION I	RATIONALE: (I	f applicable)		
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REMARKS: IOA ASSESSED CRIT REQUIRED.	FICALITY BASE	O ON CONDITIONS	WHERE COOLING IS	3
IOA ACCEPTS NASA	APPROACH.			

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/8 APU-244 04-2-CS			NASA DATA BASELINE NEW	=			
SUBSYSTEM: MDAC ID: ITEM:	APU 244 INJECTO	R COOLII	NG WATER I	LINE HEATER	THERMOSTAT			
LEAD ANALYST:	J. BARN	ES						
ASSESSMENT:								
CRITICAL FLIGH HDW/FU	${f T}$	REDUNDA A	ANCY SCREE B	ens C	CIL ITEM			
NASA [3 /3 IOA [3 /1R] [NA] P]	[NA] [NA]	[NA] [P]	[] *			
COMPARE [/N) [и ј	[]	[и]	[]			
RECOMMENDATIONS:	(If d	ifferen	t from NAS	SA)				
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* CIL RETENTION	RATIONAL	E: (If	applicable	ADEQUATE	[]			
INADEQUATE [] REMARKS: IOA ASSESSED CRITICALITY BASED ON CONDITIONS WHERE COOLING IS REQUIRED.								
IOA ACCEPTS NASA APPROACH.								

	12/10/86 APU-245 04-2-CS03-1	PU-245 BASELINE [
SUBSYSTEM: MDAC ID: ITEM:	APU 245 INJECTOR COOL	LING WATER LINE HEA	TER THERMOSTAT							
LEAD ANALYST:	J. BARNES									
ASSESSMENT:										
CRITICA FLIG		DANCY SCREENS	CIL ITEM							
	UNC A	.В C	ITEM							
NASA [3 /3 IOA [3 /3] [NA]] [NA]	[NA] [NA] [NA] [NA]	[] *							
COMPARE [/] . []	[] []	[]							
RECOMMENDATIONS	: (If differe	ent from NASA)								
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* CIL RETENTION	RATIONALE: (If	applicable) ADEQU INADEQU								

REMARKS:

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	APU-246		NASA DATA: BASELINE [] NEW [X]							
SUBSYSTEM: MDAC ID: ITEM:	APU 246 FUEL PU	MP/GGVM	COOLING F	RELIEF VALVE						
LEAD ANALYST:	J. BARN	ES								
ASSESSMENT:										
CRITICAL FLIGH	T		ANCY SCREE		CIL ITEM					
HDW/FU	NC .	A _.	В	С						
NASA [3 /3 IOA [2 /1R] [NA] P]	[NA] [NA]	[NA] [P]	[x] *					
COMPARE [N /N] [N]	[]	[N]	[N]					
RECOMMENDATIONS:	(If d	ifferen	t from NAS	SA)						
[/] - []	[]	[] (A	[] DD/DELETE)					
* CIL RETENTION	RATIONAL	E: (If	applicable	ADEQUATE INADEQUATE	[]					
REMARKS: IOA ASSESSED CRI REQUIRED.	TICALITY	BASED	ON CONDITI		OOLING IS					
IOA ACCEPTS NASA	APPROAC	н.								

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MDAC ID:				24	7	PUI	MP/	'GGVM	C	OOLIN	ig R	ΕI	JEF	VALV	Έ				
LEAD ANA	LY	ST	:	J.	BA	RNI	ES												
ASSESSME	NT	:																	
		F	ICAI LIGH W/FU	_			RE A	DUND.	ANC	CY SC	REE		c			CI IT		Ī	
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RECOMMEN	DA?	CIC	ons:	: ((If	d:	iff	eren	t 1	from	NAS.	A)							
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ASSESSME	TN	I	D:	APU-	12/10/86 NASA DATA: APU-248 BASELINE [04-2-CL10-1 NEW [[x]		
SUBSYSTE MDAC ID:				APU 248 FUEL	, PU	MP,	/GGV	7M (.	LIN	G RE	LII	EF V	VALVE				
LEAD ANALYST: J. BARNES																		
ASSESSME	NT	:																
	CR		ICAL: LIGH:	ITY T		R	EDUN	IDA1	ICY	sc	REENS	3				IL CEM	ſ	
	1	HD	W/FUI	NC		A			В			С						
NASA IOA	[[3 2	/3 /1R]]	P P]	1	P]]	P P]		[x]	*
COMPARE	[N	/N]	[]	[]	[]		[N]	
RECOMMEN	DA!	ΓI	ons:	(I	fd	if:	fere	ent	fr	om	nasa))						
•	[/	3	[]	. (•]	[]	(A)	[DD/	/DE] ELE	ETE)
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	12/10/86 APU-249 NONE	NASA DATA BASELINE NEW	
MDAC ID:	APU 249 FUEL PUMP/GGVM	COOLING GN2 LINE	
LEAD ANALYST:	J. BARNES		
ASSESSMENT:			
CRITICALI FLÌGHI	TY REDUNDA	NCY SCREENS	CIL ITEM
HDW/FUN		ВС	licm
NASA [/ IOA [2 /1R] []] [P]	[] [] [P] [P]	[] * [x]
COMPARE [N /N] [N]	[N] [N]	[N]
RECOMMENDATIONS:	(If different	from NASA)	
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* CIL RETENTION F	RATIONALE: (If a	pplicable) ADEQUATE INADEQUATE	
REMARKS: NASA ANALYSIS DID OF CRITICALITY.	NOT CONSIDER T	HIS ITEM. NO ISSUE,	

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:				NASA DATA BASELINE NEW	-	
	APU 250 FUEL PU	MP/GGVM	COOLING V	ALVE		
LEAD ANALYST:	J. BARNI	ES				
ASSESSMENT:						
CRITICAL: FLIGHT		REDUNDA	ANCY SCREE	ens	CIL ITEM	
HDW/FUI	NC	A	В	С		
NASA [3 /3 IOA [3 /1R] [NA] P]	[NA] [NA]	[NA] [P]	[]	*
COMPARE [/N] [ו א	[]	[N]	[]	
RECOMMENDATIONS:	(If d	ifferent	t from NAS	SA)		
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* CIL RETENTION 1	RATIONALI	E: (If a	applicable	ADEQUATE INADEQUATE	[]	
REMARKS: IOA ASSESSED CRIT REQUIRED.	FICALITY	BASED (ON CONDITI			IS

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	APU-251	NASA DATA: BASELINE [] NEW [X]								
SUBSYSTEM: MDAC ID: ITEM:	APU 251 FUEL PUM	IP/GGVM	COOLING V	/ALVE						
LEAD ANALYST:	J. BARNE	S								
ASSESSMENT:										
CRITICAL: FLIGHT		REDUNDA	NCY SCREE	ens	CIL ITEM					
HDW/FU		A	В	С						
NASA [3 /3 IOA [2 /1R] [NA] P]	[NA] [NA]	[NA] [P]	[x] *					
COMPARE [N /N] [и]	[]	[N]	[N]					
RECOMMENDATIONS:	(If di	fferent	from NAS	A)						
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* CIL RETENTION I	RATIONALE	: (If a	pplicable	ADEQUATE	[]					
REMARKS:				INADEQUATE						
IOA ASSESSED CRIT	TICALITY	BASED O	N CONDITI	ONS WHERE CO	OOLING IS					
IOA ACCEPTS NASA	APPROACH	•								

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	APU-252			BASELIN		:]
SUBSYSTEM: MDAC ID: ITEM:	APU 252 FUEL PU	MP/GGVM	COOLING	VALVE		
LEAD ANALYST:	J. BARN	ES				
ASSESSMENT:						
CRITICAL FLIGH		REDUND	ANCY SCRE	ENS	CIL	_
HDW/FU	_	A	В	С	,	
NASA [3 /3 IOA [3 /1R] [NA] P]	[NA] [NA]	[NA] [P]	[] *.
COMPARE [/N] [и]	[]	[N]	[]
RECOMMENDATIONS:	(If d	ifferen	t from NA	SA)		
1] []	[]	[]	· [(ADD/D] ELETE)
* CIL RETENTION	RATIONAL	E: (If	applicabl	ADEQUATI		j
REMARKS: IOA ASSESSED CRI REQUIRED.	TICALITY	BASED	ON CONDIT	INADEQUATI	-] :NG IS
IOA ACCEPTS NASA	APPROAC	H.				

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/8 APU-253 04-2-CI	3	·1				NASA DAT BASELIN NE	Œ [x]	
SUBSYSTEM: MDAC ID: ITEM:	APU 253 FUEL PU	JMP/	'GGVM	C001	LING V	7AL	VE			
LEAD ANALYST:	J. BARN	NES	•							
ASSESSMENT:										
CRITICAL FLIGH HDW/FU	r	RE A	DUNDA	NCY B	SCREE		c	CI	L EM	
•										
NASA [3 /3 IOA [3 /1R) ([P [P]	[P [N/] A]	[P] P]	[] *	
COMPARE [/N) [[]	[N]	[]	[]	
RECOMMENDATIONS:	(If d	liff	erent	fro	om NAS	SA)				
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* CIL RETENTION	RATIONAI	LE:	(If a	ppli	icable		ADEQUATE ADEQUATE]	
REMARKS:								L	J	

ASSESSME ASSESSME NASA FME	NT	II	D:	AP	U-25	54		5-2	NASA DATA: BASELINE [] NEW [X]														
SUBSYSTE MDAC ID: ITEM:	M:			AP 25 FU	4	יטי	IP/	'GGVI	M C	:0	OL	ING	; w	ľA	EI	₹ !	ΓAΝ	ΙK					
LEAD ANA	LYS	ST	:	J.	BAF	(NS	ES																
ASSESSME	NT	:																					
	CR:		ICAL: LIGH:				RI	EDUNI	DAN	C	Y	SCR	REE	NS							L CEM	1	
	1	HDI	W/FUI	NC			A				В				С								
NASA IOA]	3 2	/3 /1R]		[NA P	A]	[:	NA P]		[NA P	\]				[x]	*
COMPARE	[N	/N]		[N]	{	,	N]		[N]				[N]	
RECOMMEN	DA'	ri	ons:		(If	đ:	ifi	fere	nt	f	rc	m N	IAS.	A)	١								
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* CIL RE	TEI	NT:	ION I	RAT	ION	ΛL	€:	(If	aŗ	q	li	cab	ole)					_			•	
														I			QU2 QU2]	
REMARKS: IOA ASSE REQUIRED		ED	CRI	ric	ALI	ĽΥ	BA	ASED	ON	1	CC	NDI	TI	01	15	W.	HEI	RE	C	00	LII	NG	IS
TOA ACCE	יים	S 1	MASA	ΔÞ	PRO	A CI	Ħ.																

	APU-255								
	APU 255 FUEL PUMP/	GGVM COOLING W	ATER TANK						
LEAD ANALYST:	J. BARNES								
ASSESSMENT:									
CRITICAL: FLIGH		DUNDANCY SCREE	NS	CIL ITEM					
HDW/FUI		. B	С	4 4 22 4					
NASA [3 /3 IOA [2 /1R] [NA] [P] [NA]] [P]	[NA] [P]	[] * [X]					
COMPARE [N /N] [N]] [N]	[N]	[N]					
RECOMMENDATIONS:	(If diffe	erent from NAS	A)						
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* CIL RETENTION 1	RATIONALE:) ADEQUATE INADEQUATE	[]					
REMARKS: IOA ASSESSED CRIT REQUIRED.	CICALITY BAS								

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	APU-256	NASA DATA: BASELINE NEW	
	APU 256 FUEL PUMP/GGVM	COOLING WATER LINES-	BETWEEN TANK
LEAD ANALYST:	J. BARNES		
ASSESSMENT:			
CRITICAL: FLIGH	r	ANCY SCREENS	CIL ITEM
HDW/FUI	NC A	ВС	
NASA [3 /3 IOA [2 /1R] [NA]] [P]	[NA] [NA] [P] [P]	[x] *
COMPARE [N /N] [и]	[и] [и]	[N]
RECOMMENDATIONS:	(If differen	t from NASA)	
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* CIL RETENTION 1	RATIONALE: (If	applicable) ADEQUATE INADEQUATE	[]
REMARKS: IOA ASSESSED CRIT REQUIRED.	FICALITY BASED	ON CONDITIONS WHERE CO	OOLING IS
TON ACCEPTE NASA	A DDDOACH		

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/86 APU-257 NONE		NASA DATA: BASELINE [] NEW [X]											
SUBSYSTEM: MDAC ID: ITEM: AND TANK VALVES	APU 257 FUEL PUMP/GO													
LEAD ANALYST: J. BARNES														
ASSESSMENT:	·													
CRITICALI FLIGHT		JNDANCY SCREENS	CIL ITEM											
HDW/FU	IC A	ВС												
NASA [/ IOA [2 /1R] [p]	[] [] [P] [P]	[] * [x]											
COMPARE [N /N] [N]	[и] [и]	[N]											
RECOMMENDATIONS:	(If differ	cent from NASA)												
\]] []	[] []	[] (ADD/DELETE)											
* CIL RETENTION F	RATIONALE: (1	If applicable) ADEQUA	ATE []											
REMARKS:		INADEQUA	. ,											
		ER THIS FAILURE MODE. E IS NOT CREDIBLE.	. IOA CONCURS											

	12/10/86 APU-258 04-2-CFD02-3	NASA DATA: BASELINE [] NEW [X]												
	APU 258 FUEL PUMP/GGVM	COOLING WATER FILL CO	OUPLING											
LEAD ANALYST:	J. BARNES													
ASSESSMENT:														
FLIGH!			CIL ITEM											
HDW/FU	NC A	ВС												
NASA [3 /3 IOA [2 /1R] [NA]] [P]	[NA] [NA] [P] [P]	[x] *											
COMPARE [N /N] [N]	[N] [N]	[N]											
RECOMMENDATIONS:	(If differen	t from NASA)												
[/	1 []	[] [] (A)	[DD/DELETE)											
* CIL RETENTION	RATIONALE: (If	applicable) ADEQUATE INADEQUATE												
REMARKS: IOA ASSESSED CRI' REQUIRED.	FICALITY BASED	ON CONDITIONS WHERE CO	OOLING IS											

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/86 APU-259 NONE		NASA DATA: BASELINE [] NEW [X]											
	APU 259 FUEL PUMP/GO	GVM COOLING WA	TER FILL (COUPLING										
LEAD ANALYST:	J. BARNES													
ASSESSMENT:														
CRITICAL: FLIGHT HDW/FUI	r	INDANCY SCREEN B	s c	CIL ITEM										
		_												
NASA [/ IOA [3 /3] []]] [] [AN]	NA]	[] *										
COMPARE [N /N] [N]	[N]	N]	[]										
RECOMMENDATIONS:	(If differ	ent from NASA)											
\]] []	[] [] (A	[] ADD/DELETE)										
* CIL RETENTION H	RATIONALE: ()		ADEQUATE											
REMARKS:	17000 MILLS		NADEQUATE	• •										
NASA DID NOT CONS OF SYSTEM IMPACT.	SIDER THIS FA	ILURE MODE. 1	NO ISSUE,	DUE TO LACK										

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/86 APU-260 04-2-CL10-1	NASA DATA: BASELINE [] NEW [X]										
SUBSYSTEM: MDAC ID: ITEM: VALVE AND APU	APU 260 FUEL PUMP/GGVN	M COOLING WATER LINES-	BETWEEN TANK									
LEAD ANALYST: J. BARNES												
ASSESSMENT:												
CRITICAL: FLIGHT	CIL ITEM											
HDW/FUI	NC A	В С										
NASA [3 /3 IOA [2 /1R		[NA] [NA] [P]	[] * [x]									
COMPARE [N /N] [N]	[N] [N]	[N]									
RECOMMENDATIONS:	(If differen	nt from NASA)	. ·									
t ,	1 . []	[] []	[] ADD/DELETE)									
* CIL RETENTION	RATIONALE: (If	applicable) ADEQUATE INADEQUATE	[]									
REMARKS: IOA ASSESSED CRIT REQUIRED.	FICALITY BASED	ON CONDITIONS WHERE O	COOLING IS									

ASSESSME ASSESSME NASA FME	NT	I			J-26					NASA DATA: BASELINE [] NEW [X]										
SUBSYSTE MDAC ID: ITEM: VALVE AN		ΑP		APU 26: FUI											-BETWEEN TAN					
LEAD ANALYST: J. BARNES																				
ASSESSME	NT	:																		
		F	ICAL LIGH W/FU	r			RI A	EDUN	DAN	CY B	sc	REF		С		CI	L EM			
NASA			•			r		,	r		1		r		,	r	1	*		
IOA	[3	/ /1R]		[P]	[P]		[P]	[]	•		
COMPARE	[N	/N]		[N]	[N]		[N]	[]			
RECOMMEN	DA!	rI	ONS:		(If	d:	if;	fere	nt	fr	om	NAS	A)				,			
	[/]		[]	[]		[] (2	[ADD/	DEL.	ETE)		
* CIL RE	TEI	NT:	ION I	RATI	CONA	L	Ξ:	(If	ap	p1 :	ica	ble	2)							
								•	•	•			•		EQUATE EQUATE	[[]			
REMARKS: NASA ANA	LY	SIS	S DII) и	OT C	:01	NSI	DER	тн	IS	FA	ILU	RE	M	ODE (L)	NE	BLO	CKAGE		
AT FILTE	R)														Y FMEA					

ASSESSMEN' ASSESSMEN' NASA FMEA	r II):	12/10 APU-2 04-2-	62		1	NASA DATA: BASELINE [] NEW [X]									
SUBSYSTEM MDAC ID: ITEM:	:		APU 262 FUEL	=										ÆX I	HOS	E
LEAD ANALYST: J. BARNES																
ASSESSMENT:																
C.	F	ICALI LIGHT			RE A	DUND?	ANC	CY B	SCRE	EENS	c			CIL	M	
NASA IOA	[3 [3	/3 /1R]	[P P]	[P P]	[P P]] []	*
COMPARE	[/N	3	[]	[]	[]		£]	
RECOMMENDA	ATIC	ons:	(If	d:	lff	erent	: 1	fro	om NA	ASA)						
	[.	/]	[]	[]	[(AI	[DD/D] ELE	ETE)
* CIL RET	ENT	ON I	RATION	ALI	E :	(If a	pp	oli	cabl	Ť		EQUATI		[]	
REMARKS: IOA ASSESS REQUIRED.	SED	CRIT	ricali	TY	BA	SED (N	ĊC	TIDN(OI	IS	WHERE	CC	OLI	NG	IS

ASSESSMENT DATE: 12/10/86 ASSESSMENT ID: APU-263 NASA FMEA #: 04-2-CNA01-1									NASA DATA: BASELINE [] NEW [X]											
SUBSYSTE MDAC ID:				AF 26 SF	_	0	RI)	FICE	1											
LEAD ANA	LYS	ST	:	J.	BAI	RN:	ES													
ASSESSME	NT:	:																		
		F	ICAL:	r				EDUN	DAN		S	CREE	NS					L EM		
	1	1D)	/FUI	y C			A			В				С						
NASA IOA] [3 3	/3 /1R]		[NZ P	A]]]	NZ P	A]]]	NA P]		[[]	*
COMPARE	[/N]		[N]	[N]		[N]		[]	
RECOMMEN	DAT	CIC	ons:		(If	d :	if	fere	nt	fro	om	NAS	A))						
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* CIL RE	TEN	T	ON I	TA5	'ION	ALI	Ε:	(If	ap	pl:	ica	able	:)			_	_		_	
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REMARKS: IOA ASSE REQUIRED	SSE	ED	CRIT	CIC	ALIT	Γ¥	BZ	ASED	ON	C	INC	OITI	10	IS	WHERE	CC	OL	IN	G	IS
IOA ACCE	PTS		NASA	AP	PRO	ACI	Ħ.													

	12/10/86 APU-264 04-2-CLV06-1	NASA DATA: BASELINE [] NEW [X]										
MDAC ID:	APU 264 FUEL PUMP/GGVM	COOLING WATER TANK VA	LVE									
LEAD ANALYST:	J. BARNES											
ASSESSMENT:												
CRITICALI FLIGHT HDW/FUN	r	ANCY SCREENS B C	CIL ITEM									
NASA [3 /3 IOA [2 /1R] [NA]] [P]	[NA] [NA] [P] [P]	[x] *									
COMPARE [N /N] [N]	[N] [N]	[N]									
RECOMMENDATIONS:	(If different	: from NASA)										
[/] []	[] [] (AE	[] DD/DELETE)									
* CIL RETENTION F	RATIONALE: (If a	applicable) ADEQUATE INADEQUATE	[]									
REMARKS: IOA ASSESSED CRIT REQUIRED.	ricality based o	ON CONDITIONS WHERE CO										

ASSESSMENT DAY ASSESSMENT ID NASA FMEA #:	: APU-2		NASA DATA: BASELINE [] NEW [X]										
SUBSYSTEM: MDAC ID: ITEM:	APU 265 FUEL	PUMP/GGVM	COOLING	WATER TANK V	ALVE								
LEAD ANALYST:	J. BA	RNES											
ASSESSMENT:													
CRITICALITY REDUNDANCY SCREENS C FLIGHT I													
HDW,	/FUNC	A	В	, C									
NASA [3 ,	/3] /1R]	[NA] [P]	[NA] [NA]	[NA] [P]	[] *								
COMPARE [/n]	[N]	[]	[N]	[]								
RECOMMENDATION	NS: (If	differen	t from NA	SA)									
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* CIL RETENTIO	ON RATION	ALE: (If	applicabl		[]								
REMARKS: IOA ASSESSED O REQUIRED.	CRITICALI:	TY BASED	ON CONDIT										

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:	APU-266	•	NASA DATA: BASELINE [] NEW [X]											
MDAC ID:	APU 266 FUEL PU													
LEAD ANALYST:	J. BARN	ES												
ASSESSMENT:														
FLIG	ŀΤ		SCREENS	CIL ITEM										
HDW/F	JNC	A . I	3 C											
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COMPARE [N /N] [N] [1	иј [иј	[N]										
RECOMMENDATIONS	: (If d	lifferent fr	rom NASA)											
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* CIL RETENTION	RATIONAL	E: (If app)												
			ADEQUA' INADEQUA'	re [] re []										
REMARKS: NASA ANALYSIS D BARRIER LEAK) S			S FAILURE MODE	(INTERNAL										
IOA ACCEPTS NAS	A APPROAC	H.												

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	APU-267		NASA DATA: BASELINE [] NEW [X]									
SUBSYSTEM: MDAC ID: ITEM:	APU 267 FUEL PU	MP/GGVM	COOLING W	VATER TANK V	ALVE							
LEAD ANALYST:	J. BARN	ES										
ASSESSMENT:												
FLIGH	T		NCY SCREE		CIL ITEM							
HDW/FU	NC	A	В	, C								
NASA [3 /3 IOA [2 /1R] [NA] P]	[NA] [P]	[NA] [P]	[x] *							
COMPARE [N /N] [n j	[и]	[N]	[N]							
RECOMMENDATIONS:	(If d	ifferent	from NAS	SA)								
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* CIL RETENTION	RATIONAL	E: (If a	pplicable									
				ADEQUATE INADEQUATE	[]							
REMARKS: IOA ASSESSED CRIT REQUIRED.	FICALITY	BASED O	N CONDITI	ONS WHERE CO	OOLING IS							
IOA ACCEPTS NASA	APPROAC	н.										

ASSESSMENT DATE: 12/10/86 ASSESSMENT ID: APU-268 NASA FMEA #: 04-2-CHR01-2								NASA DATA: BASELINE [] NEW [X]											
SUBSYSTE MDAC ID:				APU 268 FUE							OLIN	IG W	R TANK	н	EATE	R			
LEAD ANALYST: J. BARNES																			
ASSESSMENT:																			
CRITICALITY REDUNDANCY SCREENS FLIGHT HDW/FUNC A B C												CIL ITEM							
	I.	ועו	W/ FUI	NC.			A				Ð			C					
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COMPARE	[/N]		[N]		[]		[N].		[]	
RECOMMEN	TAC	:IO	ons:	(Ιf	đ	Ĺfí	fere	nt	f	rom	NAS	A)					
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REMARKS: IOA ASSE REQUIRED		ED	CRI	rica	LII	Ϋ́	B	ASED	O	N	CONI	ITI					•	•	IS
IOA ACCE	PTS	5 1	NASA	APP	ROA	CI	ł.							•					

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/86 APU-269 04-2-CSC		NASA DATA: BASELINE [] NEW [X]									
SUBSYSTEM: MDAC ID: ITEM: THERMOSTAT	APU 269 FUEL PUN	MP/GGVM	COOLING W	ATER TANK H	EATER							
LEAD ANALYST:	J. BARNI	ES										
ASSESSMENT:												
CRITICAL: FLIGHT	r		NCY SCREE		CIL ITEM							
HDW/FUI	NC	A	В	С								
NASA [3 /3 IOA [3 /1R] [NA] P]	[NA] [NA]	[NA] [P]	[] *							
COMPARE [/N] [n j	[]	[N]	[]							
RECOMMENDATIONS:	(If di	ifferent	: from NAS	A)								
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* CIL RETENTION I	RATIONALE	E: (If a) ADEQUATE INADEQUATE	[]							
REMARKS: IOA ASSESSED CRIT REQUIRED.	PICALITY	BASED C	N CONDITI	ONS WHERE CO	OOLING IS							

IOA ACCEPTS NASA APPROACH.

ASSESSMENT DATE: 12/10/86 ASSESSMENT ID: APU-270 NASA FMEA #: 04-2-CS01-1														SA DAT ASELIN NE		_]	
SUBSYSTI MDAC ID: ITEM: THERMOST	;			AP 27 FU	0	PUI	MP/	GGVN	1 C	00	LING	WA:	ГER	TANK	HE	ATE	ER	
LEAD AND	ALY	ST	:	J.	ВА	RN	ES											
ASSESSMI	ENT	:																
CRITICALITY REDUNI FLIGHT HDW/FUNC A							OAN	CY B	SCR	EENS			CII					
NASA IOA	[3	/3 /3]		[NA NA	.]	[[N.	A] A]	[NA NA]]		[]	*
COMPARE	ſ		/]		[]	E]	[]		(1	
RECOMMEN	IDA'	ri(ons:		(If	d :	iff	erer	nt	fr	om N	ASA						
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* CIL RI		NT:	ION	RAT	'ION	AL	E:	(If	ap	pl.	icab			EQUATE EQUATE		[]	

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		NASA DATA: BASELINE [] NEW [X]										
	APU 271 FUEL PUMP/GGVI	M COOLING WATER LINE H	EATER									
LEAD ANALYST:	J. BARNES											
ASSESSMENT:												
CRITICAL FLIGH		DANCY SCREENS	CIL ITEM									
HDW/FU	NC A	ВС										
NASA [3 /3 IOA [3 /1R] [NA]] [P]	[NA] [NA] [NA] [P]	[] *									
COMPARE [/N] [N]	[] [N]	[]									
RECOMMENDATIONS:	(If differen	nt from NASA)										
[/] []	[] [] (A	[] .DD/DELETE)									
* CIL RETENTION 1	RATIONALE: (If	applicable) ADEQUATE INADEQUATE	[]									
REMARKS: IOA ASSESSED CRIT REQUIRED.	FICALITY BASED	ON CONDITIONS WHERE C	OOLING IS									

IOA ACCEPTS NASA APPROACH.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/8 APU-272 04-2-CS		NASA DATA: BASELINE [] NEW [X]									
	APU 272 FUEL PU	MP/GGVM	COOLING V	VATER LINE HE	CATER							
LEAD ANALYST:	J. BARN	ES										
ASSESSMENT:												
CRITICAL: FLIGH HDW/FU	r	REDUNDA A	ANCY SCREE	ens C	CIL ITEM							
NASA [3 /3 IOA [3 /1R] [NA] P]	[NA] [NA]	[NA] [P]	[]	*						
COMPARE [/N] [N]	[]	[N]	[]							
RECOMMENDATIONS:	(If d	ifferent	from NAS	SA)	·							
[/] []	[]	[] (AI	[] DD/DELE	TE)						
* CIL RETENTION 1	RATIONAL	E: (If a	applicable	ADEQUATE	[]							
REMARKS: IOA ASSESSED CRIT REQUIRED.	PICALITY	BASED C	ON CONDITI	INADEQUATE	[]	IS						
IOA ACCEPTS NASA	APPROAC	н.										

ASSESSMI NASA FMI	ENT	I	D:	APU	10/8 -273 2-CS		-1		BASELINE [] NEW [X]									
SUBSYSTEMDAC ID ITEM:	:			APU 273 FUE	L PU	MP,	/GG'	VM C	OOL	ing W	ΑT	ER	LINE	HE	ATEI	3		
LEAD AN	ALY	ST	:	J. 1	BARN	ES												
ASSESSMI	ENT	:																
	CRITICALITY REDUN FLIGHT HDW/FUNC A								CY S	SCREE		CIL ITEN	1					
NASA IOA	[3	/3 /3]	[NA P	A]]	NA NA]	[NA P	.]		[]	*	
COMPARE	[/]	[N]	[:	l	[N]		[]		
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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/86 APU-274 NONE	NASA DATA: BASELINE NEW	[x]
SUBSYSTEM: MDAC ID: ITEM:	APU 274 FUEL PUMP/GGVM COOLING CHE	CK VALVE	
LEAD ANALYST:	J. BARNES		
ASSESSMENT:			
CRITICAL: FLIGH HDW/FU	T		CIL ITEM
NASA [/ IOA [3 /1R] [] [] [] [P] [P] [P]	[] *
COMPARE [N /N] [N] [N] [n]	[]
RECOMMENDATIONS:	(If different from NASA)		
. [/] [] [] [`] (AD	[] D/DELETE)
	RATIONALE: (If applicable)		[]
REMARKS: NASA ANALYSIS DI OF CRITICALITY.	D NOT CONSIDER THIS ITEM.	NO ISSUE,	DUE TO LACK

ASSESSME ASSESSME NASA FME	ENT	I	D:	12/1 APU- NONE	275		NASA DATA: BASELINE [] NEW [X]									
SUBSYSTE MDAC ID:				APU 275 FUEL	PUM	P/GGVI	M COO	LING	CHE	CK VALVE						
LEAD ANA	LY	ST	:	J. B.	ARNE	s										
ASSESSME	ENT	:														
		F	LIGH			REDUN					CIL					
]	HD	W/FU	NC		A	В		(
NASA IOA	[3	/ /3]	[]] NA]	[N] A]	[]] [A]	[] *]				
COMPARE	[N	/N	1	[]	и]	[N	3	[]	1]	[]				
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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:			NASA DATA: BASELINE [] NEW [X]										
MDAC ID:	APU 276 EXHAUST	PLENUM H	OUSING										
LEAD ANALYST:	J. BARNE	ES											
ASSESSMENT:													
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LEAD ANA	LYST	:	J. BA	RNE	S												
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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/86 APU-279 04-2-GT11	2		NASA DATA BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	APU 279 GEARBOX H	OUSING	;		
LEAD ANALYST:	J. BARNES	;			
ASSESSMENT:					
CRITICAL: FLIGHT HDW/FUI	r		NCY SCRE	ENS C	CIL ITEM
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ASSESSMENT DATE:	8/05/87			NASA DAT	A:
ASSESSMENT ID:				BASELIN	
NASA FMEA #:	05-6N-2	035-2		NE	w (x)
SUBSYSTEM:	APU				
MDAC ID:	282		•		
ITEM:	"APU CO	NTROL" S	SWITCH		
LEAD ANALYST:	J. BARN	ES			
ASSESSMENT:					
CRITICA	LITY	REDUNDA	ANCY SCRI	EENS	CIL
FLIG					ITEM
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LEAD ANA	LY	ST	:	J.	BARN	ES						
ASSESSME	NT	:										
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	APU 284 APU CONTROL C	284 APU CONTROL CIRCUIT GROUND CONT										
LEAD ANALYST:	J. BARNES	J. BARNES										
ASSESSMENT:												
CRITICALI FLIGHT HDW/FUR	ľ	c	CIL ITEM									
NASA [3 /3 IOA [3 /3] [NA]] [NA]	[AN] [AN]	NA] NA]	[] *								
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LEAD ANA	LYSI	?:	J.	BARN	IES	;											
ASSESSME	NT:																
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SUBSYSTEM MDAC ID: ITEM:		APU 287 APU C	ONTR	OL C	IRCU	rıt	ST	ART	CONTRO	L II	NPU	JT	DI	ODE
LEAD ANAL	YST:	J. BA	RNES											
ASSESSMEN	T:													
c	RITICA FLIG		R	EDUNI	DANC	Y	SCRI	EENS	5		CI	L	ſ	
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COMPARE	[N /N]	[N]	[N]	נ	и ј		[N]	
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ASSESSMENT DA ASSESSMENT ID NASA FMEA #:	•	88		NASA DATA BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	APU 288 "APU	CNTLR PWF	R" SWITCH		
LEAD ANALYST:	J. BA	RNES			
ASSESSMENT:					
FI	CALITY LIGHT V/FUNC	REDUNI A	DANCY SCRE	ens C	CIL ITEM
NASA [2 IOA [2	/1R] /1R]	[P] [P]	[P] [P]	[P] [P]	[X] * [X]
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* CIL RETENTI	ON RATION	ALE: (If	applicable	e) ADEQUATE INADEQUATE	[]
REMARKS:					

ASSESSMEN ASSESSMEN NASA FME	NT I	ID:	8/05/8 APU-28 05-6N-	39	6-1			;	NASA DAT BASELIN NE	E []
SUBSYSTEM MDAC ID:	M:		APU 289 "APU (CNTL	R PWR	R" SW	ITCH				
LEAD ANA	LYSI	r:	J. BAI	NES							
ASSESSME	NT:										
	F	ricali FLIGHT	C	R A		ANCY B	SCRE		c	CII	_
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REMARKS:									~	•	•

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SUBSYSTEM: MDAC ID: ITEM:		APU 290 "APU CI	NTLR	PWR"	SW	VITCH					
LEAD ANALY	ST:	J. BAR	NES								
ASSESSMENT	:										
CR	ITICAL: FLIGH		RE	DUNDA	NCY	SCREE	ens			CIL ITEI	
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LEAD ANA	LY	ST	:	J.	BAR	IN3	ES													
ASSESSME	NT	:																		
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ASSESSME	ESSMENT DATE: 1/06/88 ESSMENT ID: APU-292 A FMEA #: 05-6N-2017-1 SYSTEM: APU															SASELI		[x]	
SUBSYSTE MDAC ID:				29	_	LI	ER	POV	WEI	2	CI	RCU	JIT	R	PC	:					
LEAD ANA	LY	ST	:	J.	BARI	IES	3														
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ASSESSME	SSESSMENT DATE: 8/05/87 SSESSMENT ID: APU-293 ASA FMEA #: 05-6N-2017-2								NASA DATA: BASELINE [] NEW [X]							
SUBSYSTE MDAC ID:	M:		APU 293 CONTRO) DL	LEI	R POW	ER	C	IRCUI!	r :	RP	С				
LEAD ANA	LYST	r:	J. BAI	RNI	ES											
ASSESSME	NT:															
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REMARKS:												~	•		J	
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ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:	APU-295	1	NASA DATA BASELINE NEW		
SUBSYSTEM: MDAC ID: ITEM:	APU 295 CONTROLLER	POWER SWITCH I	POWER FUSE		
LEAD ANALYST:	J. BARNES				
ASSESSMENT:					
CRITICA FLIG		UNDANCY SCREEN	IS	CIL ITEM	
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SUBSYSTEM: MDAC ID: ITEM:	APU 296 CONTRO	LLER POW	VER CIRCUI	T CONTROL 1	INPUT	DIODE
LEAD ANALYST:	J. BARI	NES				
ASSESSMENT:						
CRITIC FLIC HDW/	SHT	REDUND A	B	ENS C	CIL	
NASA [3 /: IOA [3 /:	LR] [[P] [P]	[NA] [P]	[P] [P]	[] *
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* CIL RETENTION	RATIONAI	LE: (If	applicabl	e) ADEQUATE INADEQUATE]
REMARKS:					·	J

ASSESSMENT DATE: 1/06/88 ASSESSMENT ID: APU-297 NASA FMEA #: 05-6N-2032-1							NASA DATA: BASELINE [] NEW [X]							
SUBSYSTE MDAC ID: ITEM: DIODE			APU 297 CONTI	ROLL	ER PO	WER	CIRCU	IT G	ROUND	CONT	ROL	INPUT		
LEAD ANA	LYST	:	J. B	ARNE	S									
ASSESSME	ENT:													
		LIGH	T			IDANC	Y SCR				CIL ITEN	1		
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COMPARE	[/N]		[N]		[N]	[N]			[]	
RECOMMEN	IDA:	ric	ons:		(If	di	if	fere	ent	f	ro	m NA	SA)							
	[/]		[]		[]	[]	((AI	[DD/	/DI] ELI	ETE
* CIL RI		T)	ON I	RAT	IONA	LI	Ξ:	(Ii	f a	pp	li	.cabl	•			UATI UATI		[]	

NASA ANALYSIS DOES NOT CONSIDER THE SWITCH SEPARATELY.

		DATE:	,	6/88						SA DAT		_	
ASSESSME NASA FME				J-299 -6N-20	0400	-1			ŀ	BASELIN NE	-	x]	
SUBSYSTE MDAC ID: ITEM:			APU 299 "AF)	ED S	ELEC:	Lu :	SWITCH					
LEAD ANA	LYS'	T:	J.	BARNE	S								
ASSESSME	NT:												
		TICAL FLIGH		:	REDU	NDANG	CY (SCREEN	s		CI	L	
	H	DW/FU	NC	•	Α.		В		Ċ				
NASA IOA	[:	3 /1R 3 /3]	[]	P] NA]]	P NA] [P NA]	[]	*
COMPARE	[/N]	[]	и ј	[N] [N	1	[]	
RECOMMEN	DAT:	ions:	(If di	ffer	ent i	froi	n NASA)				
•	[/]	[]	[] [] ([ADD/		

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		00400-2		NASA DATA BASELINE NEW							
SUBSYSTEM: MDAC ID: ITEM:	APU 300 "APU SPI	EED SELE	ECT" SWITC	СН							
LEAD ANALYST:	J. BARNI	ES									
ASSESSMENT:											
CRITICAL FLIGH		REDUNDA	ANCY SCREI	ens	CIL						
HDW/FU		A	В	С		· -					
NASA [3 /3 IOA [3 /3] [P] NA]	[P] [NA]	[P] [NA]	[[] *]					
COMPARE [/] [N]	[N]	[N]	[3					
RECOMMENDATIONS:	(If d	ifferent	t from NAS	SA)							
[/] [1	[]	[] (A	[.DD/D] ELETE)					
* CIL RETENTION	RATIONAL	E: (If a	applicable	e) ADEQUATE INADEQUATE	[]					
REMARKS: NASA ANALYSIS DO	ES NOT C	ONSIDER	THE SWIT	CH SEPARATEI	Υ.						
SCREENS ARE NA B	SCREENS ARE NA BY NSTS-22206, SECT. 2.3.4.b.										

ASSESSMENT DATE: 1/06/88 ASSESSMENT ID: APU-301 NASA FMEA #: 05-6N-200400-2											NASA DATA BASELINE NEW	[
SUBSYSTE MDAC ID:			APU 301 "APU	SP	EED SE	LE	CT	***	SWITC	СН					
LEAD ANA	LYST	r:	J. BA	RN	ES										
ASSESSME	NT:														
		TICAL TLIGH	ITY		REDUN	DAI	1C	Y	SCREE	ENS	5		IL PEM		
		OW/FU			A			В			С	1.1	. em		
NASA IOA	[3	3 /3]	[P] NA]		[P NA]	[P] NA]	[:]	*
COMPARE	[/]	[n j	(N]	[N]	[]	
RECOMMEN	DAT]	ons:	(If	d :	iffere	nt	f	ro	m NAS	A)	1				
•	C	/]	[NA]	(NA]	[[.DD/	DEI] LE'	TE)
* CIL RE	TENT	NOI	RATION	AL	E: (If	ap	qc	li	cable	•	ADEQUATE NADEQUATE	[]]]	
REMARKS: NASA ANA	LYSI	s do	ES NOT	C	ONSIDE	RI	PH.	E	SWITC	Ή	SEPARATEL	Υ.			
SCREENS	ARE	NA B	Y NSTS	-22	2206, 3	SEC	T		2.3.4	.k) .				

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:	: 1/06/88 APU-302 05-6N-200400-	1	NASA DATA BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	APU 302 SPEED SELECT	CIRCUIT		
LEAD ANALYST:	J. BARNES			
ASSESSMENT:				
CRITICA FLIG HDW/F	HT	DANCY SCRE B	ENS C	CIL ITEM
NASA [3 /3 IOA [3 /3] [NA]] [NA]	[NA] [NA]	[NA] [NA]	[] *
COMPARE [/] []	[]	[]	[]
RECOMMENDATIONS	: (If differe	ent from NA	SA)	
[/	1 []	[]	[]	[] ADD/DELETE
* CIL RETENTION REMARKS:	RATIONALE: (If	applicabl	e) ADEQUATE INADEQUATE	[]

IOA CONCURS WITH NASA ANALYSIS.

ASSESSMENT DATE: ASSESSMENT ID:	1/06/88 APU-303		NASA DATA: BASELINE []							
NASA FMEA #:		00400-2		NEW						
SUBSYSTEM: MDAC ID: ITEM:	APU 303 SPEED SE	ELECT C	IRCUIT							
LEAD ANALYST:	J. BARNI	ES								
ASSESSMENT:										
CRITICAL		REDUND	ANCY SCRE	ENS	CIL					
FLIGH HDW/FU		A	В	C .	ITEM					
NASA [3 /3 IOA [3 /3] [P] NA]	[P] [NA]	[P] [NA]	[] *					
COMPARE [/] [и ј	[א]	[N]	[]					
RECOMMENDATIONS:	(If di	fferen	t from NA	SA)						
(/] [NA]	[NA]		[DD/DELETE					
* CIL RETENTION	RATIONALE	E: (If a	applicabl	e) ADEQUATE INADEQUATE	[]					
REMARKS: SCREENS ARE NA B	Y NSTS-22	206, SI	ECT. 2.3.	4.b.						

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	APU-304			BASELINE NEW	
	APU 304 OVERSPEEI	D/UNDERSP	EED INDIC	CATION CIRC	CUIT
LEAD ANALYST:	J. BARNES	5			
ASSESSMENT:					
FLIGH'					CIL ITEM
HDW/FU	NC 2	A ,	B	Ċ	
NASA [/ IOA [3 /3] [1] [NA] [] [NA] [NA]	[] *
COMPARE [N /N] [1	и] [и	и][и]	[]
RECOMMENDATIONS:	(If di	fferent f	rom NASA)		
[/] [] [] [] (AI	[] DD/DELETE)
* CIL RETENTION	RATIONALE	: (If app		ADEQUATE NADEQUATE	[]
REMARKS: NASA ANALYSIS DO OF SYSTEM IMPACT		NSIDER TH	IS ITEM.	NO ISSUE	, DUE TO LACK

ASSESSME:			8/05/ APU-3						SA DATA ASELIN			1	
NASA FME			05-6N		42-1			D		M [X]	
SUBSYSTEMDAC ID:	M:		APU 305 "APU	AUT	o shu	JTDOWN	" SW	VITCH			•		
LEAD ANA	LYST	:	J. BA	RNE	S								
ASSESSME	NT:												
(ICAL LIGH			REDUN	IDANCY	SCF	REENS		C:	LL PEM	1	
	HD	W/FU	NC	,	A	В		С		٠.			
NASA IOA		/1R /3]	[P] NA]	[F [N	`] 'A]	[P [NA]	[X]	*
COMPARE	[/N]	[й]	[N]	[1]	[N]	
RECOMMEN	DATI	ons:	(If	di	ffere	ent fr	om N	IASA)					
	[/	1	[]	[]	[] (2	[ADD/	/DF] ELE	TE)
* CIL RE	TENT:	ION 1	RATION.	ALE	: (If	appl	icab	AD	EQUATE		x	j	
REMARKS:	ווספ ו	wt Tru	NACA	2 M 2	T.VCTC	•		INAD	EQUATE	[]	

ASSESSME ASSESSME NASA FME	NT	II	D:)6	04:	2-1						ASA DA BASELI N	NE	-]	
SUBSYSTE MDAC ID: ITEM:				APU 306 "APU A	\U'	го	SHUTI	001	wn'	' SW]	[TCI	I						
LEAD ANA	LYS	ST	:	J. BAI	N)	ES												
ASSESSME	NT:	:																
		F	LIGHT	r			EDUND!		CY B	SCRI	EENS	c			CII			
NASA IOA	[3	/1R /1R]	[P N] A]	[F NZ] A]	[P NA]		K]	[[]	*
COMPARE	[N	/]	[N]	[N]	[N	3		[]	
RECOMMEN	DAT	CIC	ons:	(If	đ:	if	ferent	.	fro	om NA	ASA)							
·	[/	3	[]	[]	[]	(AI	[DD/I			TE)
* CIL RE	TEN	T	ION I	RATIONA	L	€:	(If a	apj	pl:	icab]	•		EQUAT EQUAT]	
IOA CONC SEPARATE						_		1	DES	SIGN	CHA	NG	E HAS	PI	ROVI	:D	ΕĽ)

ASSESSMENT DATE	, ,		NASA DATA	
ASSESSMENT ID: NASA FMEA #:	APU-307 05-6N-2042	-2	BASELIN: NE	
SUBSYSTEM: MDAC ID: ITEM:	APU 307 "APU AUTO S	SHUTDOWN" SWI	тсн	
LEAD ANALYST:	J. BARNES			
ASSESSMENT:				
CRITICA FLIG HDW/FU	łT	DUNDANCY SCRE B	ENS C	CIL ITEM
NASA [3 /11 IOA [3 /3		[F] [NA]	[P] [NA]	[X] *
COMPARE [/N] [N]	[N]	[N]	[N]
RECOMMENDATIONS	: (If diffe	erent from NA	SA)	
[/] []			[] ADD/DELETE
* CIL RETENTION REMARKS:			e) ADEQUATE INADEQUATE	
IOA CONCURS WITH	I NADA ANALIS)TD.		

ASSESSME ASSESSME NASA FME	NT I	D:	8/05 APU- 05-6	308	3	2-2						DATA ELINE NEW	[]	
SUBSYSTE MDAC ID: ITEM:	M:		APU 308 "APU	JA.	JTO	SHU	JTDO	wn	" sv	VITC:	H					
LEAD ANA	LYST	':	J. E	ARI	1ES	,										
ASSESSME	NT:															
	F	ICAL: LIGH W/FUI	r	•	R A		VDAN	CY B	SCF	REEN	s c			IL TEN	Ŋ	
NASA IOA		/1R /3]	[P N] A]	[F N] A]	[P] NA]		[x]	*
COMPARE	[/N]	(N]	[N]	[и ј		[N]	
RECOMMEN	DATI	ons:	(1	fd	lif	fere	ent	fr	om N	IASA))					
	[/]	{] -	. []	[]	(A	[DD,] ELF	TE
* CIL RE	TENT	ION I	RATIC	NAI	Æ:	(If	ap	pl:	icab	-	ADEQ NADEQ	UATE UATE	[x]	

IOA CONCURS WITH NASA ANALYSIS.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		APU-309 BASELINE					
MDAC ID:	APU 309 AUTO SHUTDOV	VN SWITCH POWER FUS	SE				
LEAD ANALYST:	J. BARNES						
ASSESSMENT:							
CRITICAI FLIGH		INDANCY SCREENS	CIL				
HDW/FU	-	в с	ITEM				
NASA [3 /1R IOA [3 /3	[P] [NA]	[F] [P] [NA]	[X] *				
COMPARE [/N] [N]	[и] [и]	[N]				
RECOMMENDATIONS:	(If differ	cent from NASA)					
[/] []	[•] []	[] (ADD/DELETE)				
* CIL RETENTION	RATIONALE: ()	ADEQ	QUATE [X]				
REMARKS:		INADEÇ	QUATE []				
IOA CONCURS WITH SWITCH FOR EACH		S. DESIGN CHANGE	PROVIDES SEPARATE				

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	•		NASA DATA BASELINE NEW	
MDAC ID:	APU 310 AUTO SHUT	DOWN CONTR	OL CIRCUIT DIODE	
LEAD ANALYST:	J. BARNES			
ASSESSMENT:				
CRITICAI FLIGH HDW/FU			SCREENS C	CIL ITEM
•				
NASA [/ IOA [3 /3] [] [N] [A] [NA] [NA]	[] *
COMPARE [N /N] [N] [N] [N]	[]
RECOMMENDATIONS:	(If dif	ferent fro	om NASA)	
[/] [.] [] [] (A	[DD/DELETE)
* CIL RETENTION	RATIONALE:	(If appli	.cable) ADEQUATE INADEQUATE	[]
REMARKS: NASA ANALYSIS DO OF CRITICALITY.	ES NOT CON	SIDER THIS	ITEM. NO ISSUE	, DUE TO LACK

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/06/88 APU-311 NONE		A DATA: SELINE [] NEW [X]
SUBSYSTEM: MDAC ID: ITEM:	APU 311 AUTO SHUTDOWN	CONTROL CIRCUIT	DIODE
LEAD ANALYST:	J. BARNES		
ASSESSMENT:			
CRITICAL: FLIGH		DANCY SCREENS	CIL ITEM
HDW/FUI		в с	IIEM
NASA [/ IOA [3 /3] []]	[] [] [AN] [[AN]	[] *
COMPARE [N /N] [N]	[N] [N]	[]
RECOMMENDATIONS:	(If differer	nt from NASA)	
\ 1] []	[] []	[] (ADD/DELETE)
* CIL RETENTION I	RATIONALE: (If	ADEQ	UATE [] UATE []
REMARKS: NASA ANALYSIS DOI CRITICALITY.	ES NOT COVER TH		UE, DUE TO LACK OF

ASSESSME ASSESSME NASA FME	NT	II		APU	06/88 J-312 -6N-20	010	00-	-1				NASA I BASEI		[x]	
SUBSYSTE MDAC ID:				APU 312 FUI	2	LVE	GF	ROUN	ID	CONT	ROL	CIRCUI	T				
LEAD ANA	LYS	ST:	:	J.	BARNI	ES											
ASSESSME	NT	:															
		FI	LIGH				DUN	IDAN		Y SCR B	EENS	S C		C]	[L [EM	ſ	
		אטמ	/FU			A				_							
NASA IOA	[3 3	/3 /3]	[[NA NA]	[NA] NA]	[NA] NA]		[]	*
COMPARE	[/]	[]	C	•]	[]		[]	
RECOMMEN	DA'	ric	ons:	((If d	iff	ere	ent	f	rom N	'ASA))					
	ſ		/	3	[]			1	[]	(A	[DD/	/DF	ETI I	ETE
* CIL RE	TEI	T	EON	RAT	[ONAL]	E:	(If	aŗ	p	licab		ADEQUA NADEQUA		[]	

REMARKS:

ASSESSMENT DATE: ASSESSMENT ID:	APU-313			NASA DATA BASELINE	
NASA FMEA #:	05-6N-201	1000-2		NEW	[X]
MDAC ID:	APU 313 FUEL VALV	E GROU	ND CONTRO	oL CIRCUIT	
LEAD ANALYST:	J. BARNES	3			
ASSESSMENT:					
CRITICALI FLIGHT		REDUNDA	NCY SCREE	ens	CIL ITEM
HDW/FUN		\	В	С	TIEM
NASA [3 /1R IOA [3 /3] [F	iA]	[P] [NA]	[P] [NA]	[P] *
COMPARE [/N] [N	, ,	[N]	[N]	[N]
RECOMMENDATIONS:	(If dif	ferent	from NAS	SA)	
[/] []	[]	[] (A	[] DD/DELETE)
* CIL RETENTION F	RATIONALE:	(If a	pplicable	e) ADEQUATE INADEQUATE	[]
REMARKS: IOA CONCURS WITH	NASA ANAI	YSIS.			

ASSESSMENT DATI ASSESSMENT ID: NASA FMEA #:		013-1		NASA DAT BASELIM NI	
SUBSYSTEM: MDAC ID: ITEM:	APU 314 FUEL TAI	NK VALV	E SWITCH		
LEAD ANALYST:	J. BARN	ES			
ASSESSMENT:					
CRITIC: FLIC		REDUNE	ANCY SCR	EENS	CIL ITEM
	FUNC	A	В	C	•
NASA [2 /: IOA [2 /:	lR] [lR] [P] P]	[P] [P]	[P] [P]	[X] * [X]
COMPARE [/) [1	[]	[· ·]	[]
RECOMMENDATIONS	s: (If d	ifferer	nt from N	ASA)	
[/] []	[]	()	[] (ADD/DELETE)
* CIL RETENTION	N RATIONAL	E: (If	applicab	le) ADEQUATI INADEQUATI	
REMARKS: IOA CONCURS WI'	TH NASA AN	ALYSIS.			

ASSESSME ASSESSME NASA FME	INT	ID:	•	315	13-1			_	ASA DA BASELI N]	
SUBSYSTE MDAC ID:			APU 315 FUEL	TAN	K VAI	LVE SW	ITCH	Ī					
LEAD ANA	LYS	т:.	В	ARNE	s								
ASSESSME	NT:												
		TICAL FLIGH DW/FU	r		REDUN A	IDANCY B		REENS C			CIL		
NASA IOA	[2 /1R 2 /1R]	[P] P]	[P]	[P]	[X	[]	*
COMPARE	[/]	[]	[]	[]	(•]	
RECOMMEN	DAT	ions:	(I	f di	ffere	ent fr	om N	IASA)					
	[/]	(]	[]	. [.]	(ADI)/D] ELE	ΓE)
* CIL RE	TEN	TION 1	RATIO	NALE	: (If	appl	icab	A	DEQUAT DEQUAT		X]	

REMARKS:

IOA CONCURS WITH NASA ANALYSIS.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		13-2			: [
MDAC ID:	APU 316 FUEL TANK	K VALVE	SWITCH		
LEAD ANALYST:	J. BARNES	5			
ASSESSMENT:					
CRITICAL FLIGH	r		NCY SCREE		CIL ITEM
HDW/FU	NC A	A	В	С	
NASA [2 /1R IOA [1 /1		P]	[F] [P]	[P] [F]	[X] * [X]
COMPARE [N /N] [1	[иј	[N]	[]
RECOMMENDATIONS:	(If di	fferent	from NAS	(A)	
[/] [1	[]	[.] (Al	[] DD/DELETE)
* CIL RETENTION	RATIONALE	: (If a	pplicable	ADEQUATE	
REMARKS: IOA CONCURS WITH BREAKER TO KILL				_	

	1/06/88 APU-317 05-6N-2013	3-2		ASA DATA: BASELINE NEW	[]
MDAC ID:	APU 317 FUEL TANK	VALVE SWI	тсн			
LEAD ANALYST:	J. BARNES					
ASSESSMENT:						
CRITICAL FLIGH HDW/FU	r	DUNDANCY . B	SCREENS C	•	CIL ITEN	1
NASA [2 /1R IOA [1 /1] [P]] [F] [P] [P]	[X] *]
COMPARE [N /N]- [] [N] [N]	[]
RECOMMENDATIONS:	(If diff	erent fro	m NASA)			
[/] [] [] [[DD/DE] ELETE)
* CIL RETENTION :	RATIONALE:	(If appli	À	DEQUATE	[X]
IOA CONCURS WITH BREAKER TO KILL			IGN CHAN	GE ADDED	CIRC	TIUC

ASSESSMEN ASSESSMEN NASA FME	NT ID:	1/06/8 APU-33 05-6N	18	4-1				NASA DATA BASELINE NEW	[]
SUBSYSTEM MDAC ID: ITEM:		APU 318 FUEL	rank	VALV	E CII	RCUIT	DR	IVER		
LEAD ANA	LYST:	J. BA	RNES					•		
ASSESSME	NT:									
•	CRITICAL FLIGH HDW/FU	T	RI . A		ANCY B	SCREI		C	CIL	
NASA IOA	[3 /1R [3 /1R]	[P]	[P]	[P] P]	[] *
COMPARE	[/)	[]	[]	[1	[]
RECOMMEN	DATIONS:	(If	dif	feren	t fr	om NAS	5A)			
	[/]	[]	[]	[. j (A	[DD/D:] ELETE)
* CIL RE	TENTION	RATION	ALE:	(If a	appl:	icable		ADEQUATE ADEQUATE	[]
REMARKS:								~ -	•	3

ASSESSME ASSESSME NASA FME	ENT	I	D:	APU-	-31	9	014	1-2								DAT ELIN NE		_	x]	
SUBSYSTE MDAC ID:				APU 319 FUEI	L T	Al	1K	VAI	.VE	E (:II	RCUI	T Di	RIV	/ER						
LEAD ANA	LY	ST	:	J. 1	BAR	NE	ES														
ASSESSME	NT	:																			
·		F	LIGH	ITY T NC			RI A	EDUN	IDA	MC	Y B	SCR	EENS	s c				CI IT	L EN	1	
			•								_			_							
NASA IOA	[3 2	/1R /1R]		[[P P]		[F F]	[P P]			[X X]	*
COMPARE	[N	/]		[]		[]	[]			[]	
RECOMMEN	DA'	ΓI	ons:	(1	f	di	ff	ere	nt	. f	ro	om N.	ASA))							
•	. [/	.1		[]	•	[J	ĺ] .	(ADI	[D/	DE] ELF	ETE)
* CIL RE	TE	NT:	ION 1	RATIC	NA:	LE	2:	(If	a	pp	11	cab				JATE JATE		[[x]	
REMARKS: IOA CONC					. A	NA	LY	SIS	•	D	ES	IGN	CHA	ANG	E E	PROV	IDI	ES	I	'HF	₹EĖ

	8/05/87 APU-320 05-6N-2029-1		DATA: ELINE [] NEW [X]
MDAC ID:	APU 320 FUEL TANK VALV	/E AUTO SHUTDOWN I	ORIVER
LEAD ANALYST:	J. BARNES		
ASSESSMENT:			
CRITICAL: FLIGHT HDW/FUI	r	DANCY SCREENS B C	CIL I TEM
NASA [3 /1R IOA [3 /3] [P]] [NA]	[F] [P] [NA]	[X] * []
COMPARE [/N] [N]	[иј [иј	[N]
RECOMMENDATIONS:	(If differer	nt from NASA)	
[/	1	נ ז נ ז	[] (ADD/DELETE)
* CIL RETENTION PREMARKS:	RATIONALE: (If		UATE [X] UATE []

IOA CONCURS WITH NASA ANALYSIS.

	APU-321	9-2	NASA DATA: BASELINE [] NEW [X]							
SUBSYSTEM: MDAC ID: ITEM:	APU 321 FUEL TANK	(VALV)	E AUTO	SHUTDOWN	DRIVER	l				
LEAD ANALYST:	J. BARNES					,				
ASSESSMENT:										
CRITICAL FLIGH		EDUND	ANCY SC	REENS		CIL ITEM	Ī			
HDW/FU	NC A		В	С						
NASA [3 /1R IOA [3 /1R	[P]	[P] [P]	[P] [P]		[] *]			
COMPARE [/] []	[]	[]		[]			
RECOMMENDATIONS:	(If dif	feren	t from	NASA)						
[/] []	[]	[]	(AD	[D/DE] LETE)			
* CIL RETENTION	RATIONALE:	(If a	applica		QUATE OUATE	[]			
REMARKS:					~	L	,			

	1/06/88 APU-322 05-6N-202	7-1	NASA DATA BASELINE NEV	
	APU 322 FUEL TANK	VALVE SWITC	H POWER FUSE	
LEAD ANALYST:	J. BARNES			
ASSESSMENT:				
CRITICAL FLIGHT HDW/FUI	r	EDUNDANCY SO B	reens C	CIL ITEM
NASA [3 /1R IOA [3 /1R] [P] [P]] [F]	[P] [P]	[x] *
COMPARE [/] [] [N]	[]	[и]
RECOMMENDATIONS:	(If dif:	ferent from	NASA)	
ι` /) [] []	[]	[ADD/DELETE)
* CIL RETENTION I	RATIONALE:	(If applica	ble) ADEQUATE INADEQUATE	

IOA CONCURS WITH NASA ANALYSIS.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	8/05/87 APU-323 05-6N-2022-1		A DATA: SELINE [] NEW [X]
SUBSYSTEM: MDAC ID: ITEM:	APU 323 FUEL TANK VALVE	SWITCH OUTPUT	DIODE
LEAD ANALYST:	J. BARNES		
ASSESSMENT:			
CRITICAL: FLIGH HDW/FU	r	NCY SCREENS B C	CIL ITEM
NASA [3 /1R IOA [3 /1R] [P]] [P]	[F] [P] [F] [P]	[X] * [X]
COMPARE [/] []	[] []	[]
RECOMMENDATIONS:	(If different	from NASA)	
	1 [1	[] []	[·] (ADD/DELETE
* CIL RETENTION 1	RATIONALE: (If a		UATE [X]

REMARKS:

ASSESSMENT DAY ASSESSMENT ID NASA FMEA #:	APU-3			NASA DATA BASELINE NEV	E [X]
SUBSYSTEM: MDAC ID: ITEM:	APU 324 FUEL	TANK VALV	'E INDICA'	TOR SWITCH	
LEAD ANALYST:	J. BA	RNES			
ASSESSMENT:					
FL	CALITY IGHT /FUNC	REDUNI A	DANCY SCRI	eens C	CIL ITEM
NASA [3]	/3] /3]	[NA] [NA]	[NA] [NA]	[NA] [NA]	[] *
COMPARE [/]	[]	[]	[]	[]
RECOMMENDATIO	NS: (If	differer	nt from N	ASA)	
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LEAD ANA	LYST	:	J. BA	RNE	ES							
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ASSESSMENT DATE: 1/06/88 ASSESSMENT ID: APU-326 NASA FMEA #: 05-6N-2000-1								0-1							ASA BASI	ELI		[x]	
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	SMENT DATE: 1/06/88 SMENT ID: APU-328 FMEA #: 05-6N-2000-1												NASA BASE		[x]	
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IOA ACCE	PTS	S 1	NASA	APPRO	AC	н.												

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:			NASA DATA BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	APU 329 "PUMP/V	LV COOL" SWITCH P	OWER FUSE	
LEAD ANALYST:	J. BARN	ES		
ASSESSMENT:				
CRITICAL FLIGH	T	REDUNDANCY SCREE		CIL ITEM
HDW/FU	NC	A B	С	
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IOA ACCEPTS NASA	APPROAC	н.		

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/06/88 APU-330 05-6N-2000-1	NASA DATA: BASELINE [] NEW [X]				
	APU 330 FUEL PUMP/GGVM	COOLING CONTROL CIRCU	JIT POWER			
LEAD ANALYST:	J. BARNES					
ASSESSMENT:						
CRITICAL: FLIGH HDW/FU	r	ANCY SCREENS B C	CIL ITEM			
NASA [3 /3 IOA [3 /1R] [NA]] [P]	[NA] [NA] [F] [P]	[x] *			
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IOA ACCEPTS NASA	APPROACH.					

	APU-331	• •					
SUBSYSTEM: MDAC ID: ITEM: INPUT DIODE	APU 331 FUEL PU	MP/GGVI	1 COOLING	CONTROL CIRC	UIT POWER		
LEAD ANALYST:	J. BARN	ES					
ASSESSMENT:							
CRITICAL FLIGH HDW/FU	T	REDUNI A	DANCY SCRE	C C	CIL ITEM		
NASA [3 /3 IOA [3 /1R] [NA] P]	[NA] [F]	[NA] [P]	[x] *		
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* CIL RETENTION REMARKS:		·		ADEQUATE INADEQUATE	[]		
IOA ASSESSED CRITICALITY BASED ON SITUATION WHERE COOLING IS REQUIRED.							
TOA ACCEPTS NASA APPROACH.							

	1/06/88 APU-332 05-6N-200	00-1	NASA DATA: BASELINE [] NEW [X]			
SUBSYSTEM: MDAC ID: ITEM: INPUT DIODE	APU 332 FUEL PUMI	P/GGVM C	OOLING CO	NTROL CIRCU	JIT POWER	
LEAD ANALYST:	J. BARNES	S				
ASSESSMENT:						
CRITICAL: FLIGH .HDW/FU	r	REDUNDAN A	CY SCREEN	s C	CIL ITEM	
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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/06/88 APU-333 05-6N-2000-1	NASA DATA: BASELINE [] NEW [X]				
SUBSYSTEM: MDAC ID: ITEM: RESISTOR	APU 333	COOLING CONTROL CIRC	CUIT INPUT			
LEAD ANALYST:	J. BARNES					
ASSESSMENT:						
CRITICAL FLIGHT HDW/FUI	r	ANCY SCREENS B C	CIL ITEM			
nDw/ FO	NC A	ь				
NASA [3 /3 IOA [3 /1R] [NA]] [P]	[NA] [NA] [F] [P]	[x] *			
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IOA ACCEPTS NASA	APPROACH.					

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/06/88 APU-334 05-6N-20	000-1		NASA DATA BASELINE NEW			
SUBSYSTEM: MDAC ID: ITEM: RESISTOR	APU 334 FUEL PU	MP/GGVM	ONTROL CIRC	UIT INPUT			
LEAD ANALYST:	J. BARNI	ES					
ASSESSMENT:							
CRITICAL: FLIGHT HDW/FU	r	REDUNDA	ANCY SCREE	vis C	CIL ITEM		
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IOA ACCEPTS NASA APPROACH.							

ASSESSME ASSESSME NASA FME	NT ID:	1/06/88 APU-335 05-6N-2			NASA DATA BASELINE NEW	
SUBSYSTE MDAC ID: ITEM: INPUT DR		APU 335 FUEL PU	MP/GGVM	COOLING	CONTROL CIRC	UIT POWER
LEAD ANA	LYST:	J. BARN	ES			
ASSESSME	NT:					
	CRITICAL FLIGH HDW/FU	r	REDUNDA A	ANCY SCRE	EENS C	CIL ITEM
NASA IOA	[3 /3 [3 /1R] [NA] P]	[NA] [F]	[NA] [P]	[x] *
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IOA ACCE	PTS NASA	APPROAC	н.		•	

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SUBSYSTE MDAC ID: ITEM: INPUT DE		ER		API 330 FU	6	MP/GG	VM C	OOLING	G CON	ITROL	CIRC	JIT	POWE	R
LEAD ANA	LY	ST	:	J.	BARN	ES								
ASSESSME	ENT	:												
		F	ICAI LIGH W/FU			REDU A	INDAN(CY SCI B	REENS	c C		CII		
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SUBSYSTE MDAC ID: ITEM: INPUT DR			APU 337 FUEL PUMP/GGVM C				C	001	LING	COI	NTRO	OL (CIRC	UI	r I	POW	ŒR
LEAD ANA	LYST	:	J. BA	RNI	ES												
ASSESSME	NT:																
,	F	ICAL LIGH W/FU	-		RI A	EDUNDA	ANC	CY B	SCRI	EENS	c C				CL CEN	ſ	
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IOA ASSESSED CRITICALITY BASED ON SITUATION WHERE COOLING IS REQUIRED. IOA ACCEPTS NASA APPROACH.																	

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/06/88 APU-338 05-6N-2000-1	DACE	DATA: CLINE [] NEW [X]
MDAC ID:	APU 338 FUEL PUMP/GGV	M COOLING CONTROL	CIRCUIT TIMING
LEAD ANALYST:	J. BARNES		
ASSESSMENT:			
CRITICALI FLIGHT HDW/FUN	י	DANCY SCREENS B C	CIL ITEM
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ASSESSMENT DATE: 1/06/88 ASSESSMENT ID: APU-339 NASA FMEA #: 05-6N-2000-1 NEW [X]
SUBSYSTEM: APU MDAC ID: 339 ITEM: FUEL PUMP/GGVM COOLING VALVE POWER DIODE
LEAD ANALYST: J. BARNES
ASSESSMENT:
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM HDW/FUNC A B C
NASA [3/3] [NA] [NA] [NA] [] * IOA [3/1R] [P] [F] [Y]
COMPARE [/N] [N] [N] [N]
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REMARKS: IOA ASSESSED CRITICALITY BASED ON SITUATION WHERE COOLING IS REQUIRED.
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	1/06/88 APU-340 05-6N-2000-1	NASA DATA: BASELINE [] NEW [X]				
	APU 340 FUEL PUMP/GGVI	M COOLING VALVE POWER	DIODE			
LEAD ANALYST:	J. BARNES					
ASSESSMENT:						
CRITICALI FLIGHT HDW/FUN	ני	DANCY SCREENS B C	CIL ITEM			
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LEAD ANA	LYST	:	J.	BARN	ES								
ASSESSME	NT:												
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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/06/88 APU-342 05-6N-2000-1	NASA DATA: BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	APU 342 FUEL PUMP/GGVM	COOLING VALVE INDICAT	TION RESISTOR
LEAD ANALYST:	J. BARNES		
ASSESSMENT:			
CRITICAL FLIGH HDW/FUI	r	ANCY SCREENS B C	CIL ITEM
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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	APU-343	NASA DATA BASELINE NEW	
	APU 343 FUEL PUMP/GGVM	COOLING TANK VALVE P	OWER FUSE
LEAD ANALYST:	J. BARNES		
ASSESSMENT:			
CRITICAL FLIGH HDW/FU	T	ANCY SCREENS B C	CIL ITEM
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REPORT DATE 02/18/88 C-245

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		NASA DATA: BASELINE [] NEW [X]							
	APU 344 FUEL PUMP/GO	EVM COOLING TANK	VALVE DRIVER						
LEAD ANALYST:	J. BARNES								
ASSESSMENT:									
CRITICAL: FLIGHT HDW/FUI	r	UNDANCY SCREENS B C	CIL ITEM						
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ASSESSME ASSESSME NASA FME	CNT	I	D:	APU-34	18	055	5-1							DATA ELINE NEW]	
SUBSYSTE MDAC ID:				APU 348 "APU I	ΗE	ATI	ER-TA	NI	(/F1	JEL L	IN	E/I	H20	sys"	SW:	IT(СН	
LEAD ANA	LY	ST	:	J. BAI	RNI	ES												
ASSESSME	ENT	:																
		F	LIGH	ITY F NC		RI A	EDUND	AN	ICY B	SCRE	EN	s c			CI:			
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IOA CONC	UR								PO	SSIBL	E :	FUI	EL 1	LEAK	AFT:	ER	TV	O
FAILURES	i R	EP.	KESEI	NIS FII	ΚĽ	H	MARU).										

ASSESSMENT DATE: ASSESSMENT ID:	8/05/87 APU-349	NASA DAT BASELIN	
NASA FMEA #:	05-6N-2055-2	NE	ew [x]
SUBSYSTEM: MDAC ID: ITEM:	APU 349 APU HEATER, TA	ANK/FUEL LINE/H20 SYS	S SWITCH
LEAD ANALYST:	J. BARNES		
ASSESSMENT:			
CRITICAL: FLIGH		DANCY SCREENS	CIL ITEM
HDW/FU		В С	
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RECOMMENDATIONS:	(If differen	nt from NASA)	
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REMARKS: IOA CONCURS WITH TWO FAILURES.	NASA ANALYSIS.	. DETONATION AND FIF	

	: 1/06/88 APU-350 NONE			NASA DATA BASELINE NEW		
SUBSYSTEM: MDAC ID: ITEM:	APU 350 FUEL/H20	HEATER C	ONTROL	CIRCUIT		
LEAD ANALYST:	J. BARNES					
ASSESSMENT:						
CRITICA FLIG	LITY R HT	EDUNDANC	Y SCRE	ens	CIL	
HDW/F	UNC A		В	С		
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RECOMMENDATIONS	: (If dif	ferent f	rom NA	SA)		
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REMARKS: NASA ANALYSIS C	ONSIDERS CI	RCUIT EL	EMENTS			-

ASSESSME ASSESSME NASA FME	NT I	ID:		51	9-2				NASA DATA BASELINI NEV	
SUBSYSTE MDAC ID: ITEM:	M:		APU 351 FUEL/	H20	HEATI	ER CO	NTRO	L CI	RCUIT	
LEAD ANA	LYSI	r:	J. BA	RNES						
ASSESSME	NT:									
•	I	TICAL:	r	R	EDUNI	DANCY	SCRI	EENS		CIL ITEM
	HI	OW/FUI	NC	A		В			С	
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IOA CONCURS WITH NASA ANALYSIS.

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SUBSYSTE MDAC ID: ITEM:			APU 352 FUEL/H	20	неатеі	R (COI	NTROL	CI	RCUIT				
LEAD ANA	LYSI	r:	J. BAR	NE	s									
ASSESSME	NT:													
	I	FLIGHT	C		REDUNDA	AN	CY B	SCRE	ens	c	C)	[L [EM	ſ	
		•	-							_				
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RECOMMEN	DAT]	cons:	(If	di	fferen	t	fr	om NA	SA)					
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REMARKS: ENGINEER	RING					RO	VE	D TO	ELJ	MINATE 1/	1 1	FA]	[LU	JRE.

ASSESSMENT D ASSESSMENT I NASA FMEA #:	ATE: 8/ D: AP 05	05/87 U-353 -6N-20	64-1		NASA DATA BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	AP 35	ับ 3			L PUMP" SWIT	СН
LEAD ANALYST	·: J.	BARNE	s			
ASSESSMENT:						
CRIT	CIL					
	LIGHT W/FUNC	С	ITEM			
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					ADEQUATE INADEQUATE	
REMARKS: IOA CONCURS	WITH NA	SA ANA	LYSIS.			<u>.</u>
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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	•			NASA DATA BASELINE NEW	
MDAC ID:	APU 354 "APU HEAT	ER-GAS G	EN/FUEL	PUMP" SWIT	СН
LEAD ANALYST:	J. BARNES				
ASSESSMENT:					
CRITICAL FLIGH	T	EDUNDANC			CIL ITEM
HDW/FU	NC A	1	3	С	
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COMPARE [N /] [] [] [1	[N]
RECOMMENDATIONS:	(If dif	ferent f	com NASA)	
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LEAD ANA	LY	ST	:	J.	BAI	RN:	ES														
ASSESSME	NT	:																			
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NASA ANALYSIS CONSIDERS CIRCUIT COMPONENTS INDIVIDUALLY.

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	'FUI	NC.			A				B			C	•						·		
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REMARKS: IOA CONC						AN?	AL	SIS	5.	N	0	SIN	GLE	F	AILU	JRE	CAI	V.	FA	ΙI	

ASSESSME ASSESSME NASA FME	INT	ID:	8/05/8 APU-3! 05-6N-	57	7-1					DATA ELINE NEW	[]
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LEAD ANA	LYS'	T:	J. BAI	RNES	}							
ASSESSME	NT:											
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REMARKS: IOA CONC	URS					LO	SS OF	LU	BE O	IL HE	ATER	rs.

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SUBSYSTE MDAC ID: ITEM:	М:		APU 358 "APU	Ј НЕА	TER,	LUBE	OIL	LINE	" SWI	гсн			
LEAD ANA	LYS	r:	J. E	BARNE	S								
ASSESSME	NT:												
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LEAD ANA	LYS	T:		J.	BAI	RN:	ES														
ASSESSME	NT:																				
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REMARKS:													•			-×-11		L		7	

IOA CONCURS WITH NASA ANALYSIS.

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SUBSYSTEM MDAC ID: ITEM:	[:	APU 360 LUBI	E OIL 1	LINE	Е НЕАТЕ	R C	ONTRO	L CIE	RCUI'	r		
LEAD ANAI	YST:	J. 1	BARNES									
ASSESSMEN	IT:											
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	HDW/F		A	-	В		C	!				
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ASSESSMENT DATE: 1/06/88 ASSESSMENT ID: APU-361 NASA FMEA #: 05-6N-2051-2						_2							DATA LINE NEW	[]	
SUBSYSTEMDAC ID:			APU 361 LUBE					AT	ER (CONT	ROI	L CI		-	^	J	
LEAD ANA	LYST	!:	J. BA	RNI	ES												
ASSESSME	NT:																
1		ICAL			RE	DUN	DAN	CY	SCF	REENS	3				IL PEI	ví	
	HD	W/FUI	NC		A			В			С						
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SUBSYSTEM MDAC ID:	M:		APU 362 BITI	E INI	'IATE	E DRI	VER						
LEAD ANA	LYST	:	J. 1	BARNES	;								
ASSESSME	NT:												
,	F	CICAL LIGH W/FU	r	F A		IDANC	Y SCR B		С		CIL		
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ASSESSMENT DATE ASSESSMENT ID:	, ,			NASA DAT BASELIN		1
NASA FMEA #:					K j W	k j
SUBSYSTEM: MDAC ID: ITEM:	APU 363 BITE IN	ITIATE	DRIVER			
LEAD ANALYST:	J. BARN	ES				
ASSESSMENT:						
CRITICA FLIG		REDUNI	DANCY SCRE	ENS	CII	
HDW/F		A	В	С	TIE	im
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REMARKS:				INADEQUATE	[J

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/06/88 APU-364 05-6N-200900-1		TA: TNE [] NEW [X]
	APU 364 "APU FUEL/H2O QTY	" GAUGE	
LEAD ANALYST:	J. BARNES		
ASSESSMENT:			
CRITICALI FLIGHT HDW/FUN	r	y screens B c	CIL ITEM
NASA [3 /3 IOA [3 /3] [NA] [] [NA] [NA] [NA] NA] [NA]	[] *
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SUBSYSTI MDAC ID: ITEM:				APU 365 "AI	5	EL/H2(O QTY	" SWI	тсн			
LEAD AND	ALY	ST	:	J.	BARN	ES						
ASSESSMI	ENT	:										
		F	ICAL LIGH W/FU			REDUI		y scr B		c	CI:	
NASA IOA	[3 3	/3 /3]	[NA] NA]	[NA] NA]	[NA] NA]	[] *
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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/06/88 APU-366 05-6N-200900-1	NASA DAT BASELIN NE	
	APU 366 "APU FUEL/H20 QTY	" SWITCH	
LEAD ANALYST:	J. BARNES		
ASSESSMENT:			
CRITICAL: FLIGHT HDW/FU	<u>r</u>	Y SCREENS B C	CIL ITEM
NASA [3 /3 IOA [3 /3		NA] [NA] NA] [NA]	[] *
COMPARE [/] [] [] []	[]
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SUBSYSTIMDAC ID:				APU 367 "AP	•	EL PRE	ess"	GAUGE	2				
LEAD AND	ALY	ST	:	J.	BARN	ES							
ASSESSMI	ENT	:											
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	APU-368 05-6N-200 APU 368 "APU EGT" J. BARNES ITY T NC [] []] [[]] [[]] [[]	APU-368 05-6N-200900-1 APU 368 "APU EGT" GAUGE J. BARNES ITY REDUNDAT NC A [NA]] [NA]] [NA]] [If different] []	APU-368 05-6N-200900-1 APU 368 "APU EGT" GAUGE J. BARNES ITY REDUNDANCY SCRE T NC A B [NA] [NA] [NA] [NA]] [[] [] (If different from NA]] [] []	APU-368 05-6N-200900-1 APU 368 "APU EGT" GAUGE J. BARNES TRUC A B C [NA]	APU-368 BASELINE [05-6N-200900-1 NEW [X APU 368 "APU EGT" GAUGE J. BARNES ITY REDUNDANCY SCREENS CIL T ITE NC A B C [NA] [NA] [NA] [NA] [] [NA] [NA] [NA] [] [NA] [NA] [NA] [] [] [] [(If different from NASA)] [] [] [] [RATIONALE: (If applicable)

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SUBSYSTI MDAC ID: ITEM:				APU 369 "AF		L TEM	IP" G	AUGE						
LEAD ANA	ALYS	ST:	:	J.	BARN	ES								
ASSESSMI	ENT	:												
		FI	CAL LIGH I/FU			REDU A	JNDAN(CY SC B	REENS	c C		CII		
NASA IOA]	3	/3 /3]	[NA]]	NA]	[[]	*
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ASSESSMENT ASSESSMENT NASA FMEA	T ID:	1/06/88 APU-370 05-6N-20	00900-1		NASA DATA BASELINE NEW	-]
SUBSYSTEM MDAC ID: ITEM:	:	APU 370 GAUGING	APU SE	CLECT SWITC	СН		
LEAD ANAL	YST:	J. BARNE	ES				
ASSESSMEN	T:						
C	RITICALI FLIGHT HDW/FUN	1C	A	B	С	CIL	I
NASA IOA	[3 /3] [NA] NA]	[NA] [NA]	[NA] [NA]	[] *
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REMARKS:							

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/06/88 APU-371 05-6N-20	00900-1		NASA DATA BASELINE NEW]
SUBSYSTEM: MDAC ID: ITEM:	APU 371 GAUGING	APU SELE	ECT SWITC	СН		
LEAD ANALYST:	J. BARNI	ES				
ASSESSMENT:						
CRITICAL FLIGH HDW/FU	${f T}$	REDUNDAN A	ICY SCREI	ENS C	CIL	-
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* CIL RETENTION	RATIONALI	E: (If ap	plicable	e) ADEQUATE INADEOUATE	[]

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SUBSYSTE MDAC ID: ITEM:	M:		APU 372 "APU	/HYD	READ	OT YO	STAR	T" T?	LKBA(CK		
LEAD ANA	LYSI	r:	J. B.	ARNE	s							
ASSESSME	NT:											
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ASSESSME	ENT	:															
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LEAD ANA	LYST	:	J.	BAI	RNE	ES										
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NASA IOA	[3	/1R /1R]		[P P]	[F]	[P P]		[]	*
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ASSESSMENT DATE:	, ,			NASA DATA	-	
ASSESSMENT ID: NASA FMEA #:	APU-375 04-2-0122	2-1		BASELINE NEW	[X]	
SUBSYSTEM: MDAC ID:	APU 375 GAS GENER) TEMPER	ATURE SENSO		
LEAD ANALYST:	J. BARNES	S				
ASSESSMENT:						
CRITICALI FLIGHT		REDUNDANC	CY SCREE	NS	CIL ITEM	
HDW/FU	NC 2	A	В	С		
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RECOMMENDATIONS:	(If dif	fferent f	rom NAS	A)		
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* CIL RETENTION F	RATIONALE:	: (If app	licable)		
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A VEHICLE ENGINEE	ERING CHAN	NGE HAS E	LIMINAT	ED THIS SENS	OR FROM T	ГHI
APU START LOGIC.	IOA CONC	CURS WITH	NASA A	NALYSIS.		

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		-2	NASA DATA BASELINE NEW	
SUBSYSTEM: MDAC ID:	APU 376 FUEL TEST	LINE TEMP	ERATURE SENSOR V	46T0183A
LEAD ANALYST:	J. BARNES	•		
ASSESSMENT:				
CRITICALI FLIGHT		EDUNDANCY S	SCREENS	CIL ITEM
HDW/FUN		В	С	IIEM
NASA [3 /1R IOA [3 /1R] [P] [P] [P]] [P]] [F]	[
COMPARE [/] [) [:) [N]	[N]
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* CIL RETENTION F	RATIONALE:	(If applie	cable) ADEQUATE INADEQUATE	[]
REMARKS: AN ENGINEERING CH THE CLAMP - SCREE			-	. ,

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	APU-377	BASELINE []										
	_	L CAVITY DRAIN LINE T0170A (270,370)	TEMPERATURE									
LEAD ANALYST:	J. BARNES											
ASSESSMENT:												
CRITICAL FLIGH	CIL ITEM											
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NASA [3 /1R IOA [3 /1R] [P]	[P] [P] [P] [F]	[x] *									
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* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []												
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LEAD ANA	LYS!	r:	J.	BAF	NE	s						•		
ASSESSME	ENT:													
	1	FICAL FLIGH	T			REDUN	DANC		REENS		CIL			
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REMARKS:	ED A						TRUM	ENTAT	NOI	TOGETHER,	PER	NSTS-		

ASSESSMENT DATE: 12/10/86 ASSESSMENT ID: APU-379 NASA FMEA #: 04-2-CONTL5-1															A DA SELI N	NE	[x]	
SUBSYSTE MDAC ID: ITEM:				37: CO	9)L	LEI	R SA	FE:	ľY :	MON	ITOR	IN	G						
LEAD ANA	LYS	ST	:	J.	BAI	RNI	ES													
ASSESSME	NT:	:																		
CRITICALITY REDUNDANCY SCREENS FLIGHT													CI							
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	IOA CONCURS WITH NASA ANALYSIS.																			

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LEAD ANA	ALYS	ST	:	J. BA	RN	ES													
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* CIL RE	ETEI	NT]	ION I	RATION	AL	E:	(If	а	pp	li	cabl	-		DEQU <i>A</i> DEQU <i>A</i>		[x]	

REMARKS:

	12/10/86 APU-381 NONE		NASA DATA BASELINE NEW]
MDAC ID:	APU 381 CONTROLLER POW	ER SUPPLY			
LEAD ANALYST:	J. BARNES	•			
ASSESSMENT:					
CRITICAL: FLIGHT		ANCY SCREE	NS	CIL	M
HDW/FUI	NC A	В	С		
NASA [/ IOA [3 /1R] []] [P]	[] [P]	[] [P]	[] *]
COMPARE [N /N] [N]	[и]	[N]	[]
RECOMMENDATIONS:	(If differen	t from NAS	A)		
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* CIL RETENTION I	RATIONALE: (If) ADEQUATE INADEQUATE	-	j
REMARKS: NASA ANALYSIS DOI TO THE CONTROLLER		THIS ITEM	, BECAUSE I	•	INTERNAL

ASSESSMENT DATE: 12/10/86 ASSESSMENT ID: APU-382 NASA FMEA #: 04-2-CONTL1-1									1							DAT ELIN NE	E	((x]	
SUBSYSTEM: APU MDAC ID: 382 ITEM: CONTROLLER PRIN LEAD ANALYST: J. BARNES										AF	ξY	SPE	EED	co	NTR	OL				
LEAD ANA	LYS	ST	:	J.	BA	RN]	ES													
ASSESSME	NT	:																		
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* CIL RE	TEI	NT:	ION 1	RAT	TION	ΑL	E:	(I	fa	pr) 1:	ical		A		UATE UATE		[]	

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SUBSYSTE MDAC ID:				38: CO	3	DL I	LEI	R PR	IMA	RY	SP	EED	COI	NTRO	OL					
LEAD ANA	LYS	T:		J.	BAI	RNI	ES													
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DEMADKS.												1.	IAW.	つむん(OWIL	4	L		1	

	12/10/86 APU-384 04-2-CONTL2-11		DATA: LINE [] NEW [X]
MDAC ID:	APU 384 CONTROLLER SEC	ONDARY SPEED CONT	ROL
LEAD ANALYST:	J. BARNES		
ASSESSMENT:			
CRITICAL: FLIGHT HDW/FUI	r	DANCY SCREENS B C	CIL ITEM
NASA [2 /1R IOA [2 /1R] [P]] [P]	[P] [P] [P]	[X] * [X]
COMPARE [/] []	[] []	[]
RECOMMENDATIONS:	(If differen	at from NASA)	
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* CIL RETENTION 1	RATIONALE: (If	applicable) ADEQU INADEQU	-

REMARKS:

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ASSESSME			·385			BASELIN		
NASA FME	A #:	04-2	-CONTI	L2 - 2		NE	W [X]	
SUBSYSTE MDAC ID:		APU 385 CONT	ROLLER	R SECON	DARY S	PEED CONTROL		
LEAD ANA	LYST:	J. E	BARNES					
ASSESSME	NT:							
	CRITIC	ALITY	RE	DUNDAN	CY SCR	EENS	CIL	
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ASSESSMENT DATE: 12/10/86 ASSESSMENT ID: APU-386 NASA FMEA #: NONE SUBSYSTEM: APU												DA ELI N	NE	-	x]				
SUBSYSTE MDAC ID:				APU 386 CONTR	OLI	ŒI	R A	PU :	SI	'AI	er i	LOGI	С							
LEAD ANA	LY	ST	:	J. BA	RNI	ES														
ASSESSME	ENT	:																		
		F	ICAL: LIGH! W/FUI			RI A	EDU	NDA:	NC	Y B	SCI	REEN	s c				CI II	[L PEM	1	
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NASA ANA COMPLETE	LY													N.	NC	I	SSI	JE ;	; 2	¥

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/86 APU-387 NONE		NASA DATA BASELINE NEW							
SUBSYSTEM: MDAC ID: ITEM:	APU 387 CONTROLLER	APU START LOGIC	2							
LEAD ANALYST:	J. BARNES									
ASSESSMENT:										
CRITICAL FLIGH		UNDANCY SCREENS	3	CIL ITEM						
HDW/FU		В	С	·						
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RECOMMENDATIONS:	(If diffe	rent from NASA)	l							
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REMARKS: NASA ANALYSIS DO	ES NOT CONSI	DER THIS FUNCTI	ION. NO IS	SSUE; A						
COMPLETE CONTROLLER FMEA IS PLANNED BY NASA.										

	12/10/86 APU-388 NONE		NASA DAT BASELIN NE	
MDAC ID:	APU 388 CONTROLLER "	READY" LOGI	c	
LEAD ANALYST:	J. BARNES			
ASSESSMENT:				
CRITICAL FLIGH	CIL ITEM			
HDW/FU	NC A	В	C ,	
NASA [/ IOA [3 /3] []] [NA]	[] [NA]	[] [NA]	[] *
COMPARE [N /N] [N]	[и]	[N]	[]
RECOMMENDATIONS:	(If differ	ent from NA	SA)	
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* CIL RETENTION	RATIONALE: (I	f applicabl	e) ADEQUATE INADEQUATE	
REMARKS: NASA ANALYSIS DO COMPLETE CONTROL				ISSUE; A

ASSESSMENT II NASA FMEA #:): i	12/10/8 APU-389 NONE	6		NASA DATA BASELINI NE		
SUBSYSTEM: MDAC ID: ITEM:	:	APU 389 CONTROL	LER "RE	ADY" LOGI	c		
LEAD ANALYST:	: :	J. BARN	ES				
ASSESSMENT:							
FI	CALI LIGHT N/FUNC		REDUND A	DANCY SCRE	ens C	CIL ITEM	
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COMPARE [N	/N]] [N]	[N]	[N]	[]	
RECOMMENDATIO	ons:	(If d	ifferen	t from NA	SA)		
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NASA ANALYSIS COMPLETE CONT						ISSUE; A	,

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SUBSYSTE MDAC ID: ITEM:	м:		APU 390 CONTRO	OLLE	R GEAI	пвох	PRES	SUR	E CONT	ROL			
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ASSESSME	NT:												
		TICAL FLIGH	ITY T	R	EDUND	ANCY	SCRE	ENS			CI:		
	H	DW/FU	NC	A		В			С				
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FUNCTION	IS	NOT	CHECKE	יטס כ	r by (CONT	ROLLE	R B	ITE.				

ASSESSMENT DATE: 12/10/86 ASSESSMENT ID: APU-391 NASA FMEA #: NONE																		'A: 'E ['W []			
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LEAD ANA	LYS	ST	:	J.	BAF	(NS	ES																
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COMPARE	[N	/N]		[N]		[N]		[N]			[3		
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REMARKS: NASA ANA COMPLETE																MC	DE	:.	NO	IS	SU	E;	P

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SUBSYSTI MDAC ID: ITEM:				AP 39 CO	2)L]	LEI	R GG	BE	:D	HE	ATER	٤ (201	ITRO)L						
LEAD AN	ALY	ST	:	J.	BAI	RNI	ES															
ASSESSMI	ENT	:																				
CRITICALITY REDU FLIGHT HDW/FUNC A								EDUN	UNDANCY SCREENS B C									CIL ITEM				
NASA IOA	[3 2	/1R /1R]		[P P]	[P]	•	[P P]			[x]	*	
COMPARE	[N	/]		[]	[]		[]			C	N]		
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* CIL RI		NT:	ION 1	RAT	'ION2	AL	E:	(If	aŗ	pl	ic	able				JATI JATI		[]		

IOA CONCURS WITH NASA ANALYSIS.

ASSESSMENT I ASSESSMENT I NASA FMEA #:	D: AI	2/10/86 2U-393 1-2-CONTL	3-2		NASA DATI BASELINI NEV	E []		
SUBSYSTEM: MDAC ID: ITEM:	AI 39 C0	3	GG BE	D HEATE	R CONTROL				
LEAD ANALYST	r: J.	BARNES							
ASSESSMENT:									
F	TICALITY FLIGHT DW/FUNC	RE A	DUNDAN(CY SCRE	ens C	CIL ITEM			
NASA [3 IOA [3	3 /3]	AN] AN]] [NA] NA]	[NA] [NA]	[] *		
COMPARE [/]	[] [)	[]	[]		
RECOMMENDATI	ons:	(If diff	erent :	from NA	SA)				
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* CIL RETENT	CION RAT	TIONALE:	(If ap	plicable	e) ADEQUATE INADEQUATE	[]		

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:	3 DIT - 2 O 4			NASA DAT BASELIN NE		
SUBSYSTEM: MDAC ID: ITEM:	APU 394 CONTROL	LER GG/	FUEL PUM	P HEATER INH	IBIT	
LEAD ANALYST:	J. BARN	ES				
ASSESSMENT:						
CRITIC:	ALITY	REDUNDA	ANCY SCR	EENS	CIL ITEM	
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NASA [3 /3 IOA [3 /3	3] [LR] [NA] P]	[NA] [P]	[NA] [P]	[]	*
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* CIL RETENTION	N RATIONAL	E: (If a	applicab	le) ADEQUATE INADEQUATE		
REMARKS: IOA CONCURS WI	TH NASA AN	ALYSIS.				

ASSESSMENT DATE: 12/10/86 ASSESSMENT ID: APU-395 NASA FMEA #: 04-2-CONTL3-4															'A: 'E ['W []	
SUBSYSTE MDAC ID:	M:		AP 39	บ 5			GG/F				P H:	EAT	ER	INH	IBIT	·.		
LEAD ANA	LYS	T:	J.	BAR	NES	3												
ASSESSME	NT:																	
		TICAL	łT				DUNDA	N		SCRE	EEN				CI IT	L EM		
	Н	DW/FU			P	_			В			С	•					
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RECOMMEN	DAT	'IONS	:	(If	dif	f	erent	. 1	fro	om NA	SA)						
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* CIL RE	TEN	TION	RAT	IONA	LE:	:	(If a	pı	oli	.cabl	.e)							
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REMARKS: IOA CONC			-	-							IE (OF	TWC) ME	THOD	s (OF	

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:	E: 12/10/8 APU-396 NONE			NASA DATA BASELINE NEW						
SUBSYSTEM: MDAC ID: ITEM:	APU 396 CONTROL	LER STA	RT/OVERRI	DE LOGIC						
LEAD ANALYST:	J. BARN	ES								
ASSESSMENT:										
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM HDW/FUNC A B C										
	0110									
NASA [/ IOA [3 /] [LR] [p]	[NA]	[] [P]	[] *					
COMPARE [N /	4] [N]	[N]	[N]	[]					
RECOMMENDATION	S: (If d	ifferen	t from NA	SA)						
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* CIL RETENTIO	N RATIONAL	E: (If	applicabl	e) ADEQUATE INADEQUATE	• •					
REMARKS: NASA ANALYSIS	ארת ארשי ככ	METHER	שוופ כטאיי	יים אווארים ביווארים	ON NO					
ISSUE; A COMPL										

	: 12/10/8 APU-397 NONE	6		NASA DATA BASELINE NEV	
SUBSYSTEM: MDAC ID: ITEM:	APU 397 CONTROL	LER STA	RT/OVERRI	DE LOGIC	
LEAD ANALYST:	J. BARN	ES			
ASSESSMENT:					
CRITICA: FLIG	łT		ANCY SCRE		CIL ITEM
HDW/F	JNC .	A	В	C	
NASA [/ IOA [3 /3] [NA]	[NA]	[] [NA]	[] *
COMPARE [N /N] [n]	[N]	[N]	[]
RECOMMENDATIONS	(If d	ifferen	t from NA	SA)	
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* CIL RETENTION	RATIONAL	E: (If	applicabl		
				ADEQUATE INADEQUATE	[]
REMARKS: NASA ANALYSIS D	D NOT CO	NSIDER	THIS CONT	ROLLER FUNCT	TION. NO
ISSUE; A COMPLET	TE CONTRO	LLER FM	EA IS PLA	NNED BY NASA	١.

ASSESSMENT DATE:				NASA DATA	• •
ASSESSMENT ID: NASA FMEA #:	APU-398 04-2-C01			BASELINE NEW	[X]
 	APU 398 CONTROL	LER STAI	RT/OVERRI	DE LOGIC	
LEAD ANALYST:	J. BARN	ES			
ASSESSMENT:					
CRITICA FLIG		REDUNDA	ANCY SCRI	EENS	CIL ITEM
. HDW/F		A	B	С	
NASA [1 /1 IOA [3 /1] [NA] P]	[NA] [F]	[NA] [P]	[X] * [X]
COMPARE [N /N] [N]	[N]	[N]	[]
RECOMMENDATIONS	(If d	ifferent	t from NA	ASA)	
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* CIL RETENTION	RATIONAL	E: (If a	applicabl	le) ADEQUATE INADEQUATE	
REMARKS: IOA CONCURS WITH	H NASA AN	ALYSIS.			

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	APU-399		DATA: INE [] NEW [X]
SUBSYSTEM: MDAC ID: ITEM:	APU 399 CONTROLLER ST	TART/OVERRIDE LOGIC	
LEAD ANALYST:	J. BARNES		
ASSESSMENT:			
CRITICAL FLIGH		NDANCY SCREENS	CIL
HDW/FU	NC A	ВС	
NASA [/ IOA [1 /1] []]]	[] [] [P] [F]	[x] *
COMPARE [N /N] [N]	[и] [и]	[N]
RECOMMENDATIONS:	(If differe	ent from NASA)	
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* CIL RETENTION	RATIONALE: (I	ADEQUA	
REMARKS: NASA ANALYSIS DO COMPLETE CONTROL		INADEQUA ER THIS FAILURE MODE LANNED BY NASA.	. ,
IOA WOULD RECOMM SYSTEM CRITICALI		ASA APPROACH TO INJE	CTOR COOLING

ASSESSMENT DATE: 12/10/86 ASSESSMENT ID: APU-400 NASA FMEA #: NONE														DAT ELII NI	1E	[x :]		
SUBSYSTE MDAC ID:				AP 40 CO	_	ĿEF	R E	SITE	L	og:	c									
LEAD ANA	LY	ST	:	J.	BARNI	ES														
ASSESSME	nt	:																		
CRITICALITY REDU FLIGHT HDW/FUNC A							UNDANCY SCREENS C							CIL ITEM						
•		110	11 / 1 0	110		A			•				C							
NASA IOA	[[3	/ /3]]	[[N <i>P</i>]	[]	NA :]] [N2] [[:]]	*
COMPARE	[N	/N]	[N]	(1	N j	1	[N]			[Ì	
RECOMMEN	DA!	TI(ons:		(If di	Lff	er	ent	f	roi	n N	ASA j)							
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* CIL RE	TE	NT:	ION	RAT	IONALI	E :	(1	f ap	p.	lio	cab	le)								
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REMARKS: NASA ANA		CT	g D0	rc	NOT CO) NT C	ידי	יי סיבו	ıtı.	TC	CO	MTTD/	י זר	מים	מוזם	J (∩n	PT (N		NO
ISSUE; A																		14 •		140

ASSESSMENT DATE:	12/10/86			NASA DATA BASELINE	
	APU-401X 04-2-HR11	6-11		[X]	
	APU 401 FUEL LINE	HEATER			
LEAD ANALYST:	J. BARNES				
ASSESSMENT:					
CRITICAL: FLIGH	r	EDUNDAN	CY SCREE	NS	CIL ITEM
HDW/FU	NC A		В ,	С	
NASA [3 /2R IOA [3 /1R] [F] [P] [P] NA]	[P] [P]	[X] *
COMPARE [/N] [N] [N]	[]	[N]
RECOMMENDATIONS:	(If dif	ferent :	from NAS	A)	
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* CIL RETENTION REMARKS:	RATIONALE:	(If ap	•) ADEQUATE INADEQUATE	[X]
IOA CONCURS WITH	NASA ANAL	YSIS.			

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:	APU-402X			BASELINE [] NEW [X]					
SUBSYSTEM: MDAC ID: ITEM:	APU 402 FUEL VAL	VE HEA	ГER						
LEAD ANALYST:	J. BARNE	S							
ASSESSMENT:									
CRITICA FLIC		REDUNDA	ANCY SCRI	EENS	CIL ITEM				
HDW/I		A ,	В	С					
NASA [3 /2 IOA [3 /1	R] []	F] P]	[P] [NA]	[P] [P]	[X] * []				
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RECOMMENDATIONS	: (If di	fferen	t from NA	ASA)					
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* CIL RETENTION	RATIONALE	: (If a	applicab:	le) ADEQUATE INADEQUATE					
REMARKS: TOA CONCURS WIT	TH NASA ANA	LYSIS.			-				

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	APU-403X	·2	NASA DATA: BASELINE [NEW []						
	APU 403 GEARBOX FI	LL, VEN	IT, AND	DRAIN COUPL	INGS				
LEAD ANALYST:	J. BARNES								
ASSESSMENT:									
FLIGH					CIL ITEM				
HDW/FU	NC A		В	С					
NASA [3 /1R IOA [2 /1R] [P] [P] [NA] P]	[P] [P]	[
COMPARE [N /] [] [и]	1 .	[и]				
RECOMMENDATIONS:	(If diff	erent f	rom NAS	A)					
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* CIL RETENTION	RATIONALE:	(If app	licable)					
REMARKS:			:	ADEQUATE INADEQUATE					
NASA ANALYSIS CO ANALYSIS CONSIDE					G. IOA				

ASSESSMENT DATE: ASSESSMENT ID:			NASA DATA: BASELINE []								
NASA FMEA #:				NEW							
MDAC ID:	APU 404 INTECTO	P COOLTN	G WATER '	TANK HEATER							
LEAD ANALYST:			o milin								
	U. DAM										
ASSESSMENT:		•									
CRITICAL FLIGH		REDUNDA	NCY SCRE	ENS	CIL ITEN						
HDW/FU	NC	A	В	С							
NASA [3 /3 IOA [3 /1R] [NA] P]	[NA] [NA]	[NA] [P]	[] *					
COMPARE [/N) [и ј	[]	[и]	[]					
RECOMMENDATIONS:	(If d	ifferent	from NA	SA)							
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* CIL RETENTION	RATIONAL	E: (If a	pplicable	e)							
				ADEQUATE INADEQUATE	[[]					
REMARKS: IOA ASSESSED CRI REQUIRED.	TICALITY	BASED C	N CONDIT								
IOA ACCEPTS NASA	APPROAC	н.									

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/10/86 APU-405X 04-2-CHR01-1	NASA DATA: BASELINE [] NEW [X]							
	APU 405 FUEL PUMP/GGV	M COOLING WA	TER TANK H	EATER	•				
LEAD ANALYST: J. BARNES									
ASSESSMENT:									
CRITICAL: FLIGHT HDW/FUI		DANCY SCREEN B	rs C	CIL ITEM					
NASA [3 /3 IOA [3 /1R		[NA] [[NA] [NA] P]		* 				
COMPARE [/N] [N]	[] [и]		İ				
RECOMMENDATIONS:	(If differe	nt from NASA	١)						
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* CIL RETENTION 1	RATIONALE: (If	,	ADEQUATE NADEQUATE	[]	 				
REMARKS: IOA ASSESSED CRIT REQUIRED.	TICALITY BASED	ON CONDITIO	NS WHERE CO	OOLING	; IS				

IOA ACCEPTS NASA APPROACH.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	APU-406X	5-2	NASA DATA: BASELINE [] NEW [X]							
	APU 406 "APU CONTE									
LEAD ANALYST:	J. BARNES									
ASSESSMENT:										
CRITICAL FLIGH		EDUNDANCY SCI	REENS	CIL ITEM						
HDW/FU	NC A	В	С							
NASA [1 /1 IOA [3 /3] [NA	A] [NA] A] [NA]	[NA] [NA]	[X] *						
COMPARE [N /N] [] []	[]	[N]						
RECOMMENDATIONS:	(If diff	ferent from 1	NASA)							
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* CIL RETENTION	RATIONALE:	(If applical	ole) ADEQUATE INADEQUATE							
REMARKS: IOA CONCURS WITH	NASA ANALY	sis.								

ASSESSME NASA FME	NT ID:	APU	6/88 -407X 6N-2031	1-2	BASEL		x]				
SUBSYSTE MDAC ID:	M:	APU 407 CON	FROLLE I	R PO	WER	CIRCU	UT C	ONTROL	INPU	r DIOD	E
LEAD ANA	LYST:	J. :	BARNES								
ASSESSME	NT:										
		ALITY GHT FUNC	RI A	EDUN		Y SCR B		c		CEM	
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COMPARE	[/]]	Ţ]	[]	[]	[]	
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ASSESSME								NASA DATA: BASELINE []									
ASSESSME NASA FME				-6N-2		4-1						ı	DASE.		[]	-	
SUBSYSTE MDAC ID: ITEM:			AP 40 FU		ИNК	VA:	LVE	D	RI	VER	k – 2	ΔPU	J 2,	3			
LEAD ANA	LYS	r:	J.	BAR	1ES												
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COMPARE	[/]	i	[N]		[N]	[N]		[]	
RECOMMEN	DAT:	IONS	:	(If o	lif	fer	ent	f	ro	m N	IASA))					
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REMARKS:	a ner	1 12	DTTE	DC													
SAME AS	APU	T D	KT A F	LO.													

ASSESSMENT ASSESSMENT NASA FMEA	ID:	APU-4	09X	4-2	NASA DATA: BASELINE [] NEW [X]							
SUBSYSTEM: MDAC ID: ITEM:		APU 409 FUEL	rank	VALV	E CI	RCUIT	DRI	VER - A	.PU	2,3	3	
LEAD ANALY	ST:	J. BAI	RNES									
ASSESSMENT	:											
	TTICAL: FLIGHT HDW/FUI	r	Ri A		ANCY B	SCRE	ENS C	!		IL TEN	1	
	3 /1R 3 /1R]	[P]	[F]	[F]	[X X]	*
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* CIL RETE	NTION I	RATION	ALE:	(If	appl:	icable	A	DEQUATE		x]	

SAME AS APU 1 DRIVERS.

	APU-410X	1/06/88 NASA DA APU-410X BASELI 05-6N-2000-1									
	APU 410 "PUMP/VI										
LEAD ANALYST:	J. BARNE	. BARNES									
ASSESSMENT:											
CRITICAL FLIGH	T		DANCY SCREI		CIL						
HDW/FU	NC _.	A	В	С							
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COMPARE [N /N] [и ј	[N]	(N]	ľ]					
RECOMMENDATIONS:	(If di	fferer	nt from NAS	SA)							
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* CIL RETENTION	RATIONALE	E: (If	applicable	adequate Inadequate]					
REMARKS: IOA ASSESSED CRIT REQUIRED.	PICALITY	BASED	ON SITUAT	ION WHERE CO	OLIN	G IS					

IOA ACCEPTS NASA APPROACH.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	APU-411X	NASA DATA BASELINE NEW	
	APU 411 FUEL PUMP/GGVM	COOLING CONTROL CIRC	UIT TIMIMG
LEAD ANALYST:	J. BARNES		
ASSESSMENT:			
CRITICAL: FLIGH HDW/FU	r	ANCY SCREENS B C	CIL ITEM
NASA [3 /3 IOA [3 /1R] [NA]] [P]	[NA] [NA] [F]	[x] *
COMPARE [/N] [N]	[N] [N]	[N]
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	FICALITY BASED	ON SITUATION WHERE CO	OLING IS
TOD ACCEPTS NASA	y DDDUY CA		

ASSESSMEI NASA FMEI	II TN):	APU-	122	X	-1		NASA DATA: BASELINE [] NEW [X]									
SUBSYSTER MDAC ID: ITEM: (283,383)			APU 412 FUEL 34A (2		_		IE 7	rem	PERA	\TURI	E	SENS	or v	46:	1 02	183	3A
LEAD ANA	LYST	:	J. B2	ARN)	ES												
ASSESSME	NT:																
(F	ICAL: LIGH: W/FUI			RI A	EDUN	IDAI	ICY B		REENS	c				IL PEN	M	
NASA IOA	[3 [3	/3 /1R]]	NA P]		N	A]	[[NA F	A]		[x]	*
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RECOMMENI	DATI	ONS:	(I 1	f d:	iff	ere	ent	fr	om. N	IASA))						
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IOA CONCI	JRS 1	HTIN	NASA	AN	AP	SIS	· •										

ASSESSMENT I NASA FMEA #:	D: APU-	413X		NASA DA' BASELII N	
SUBSYSTEM: MDAC ID: ITEM: SENSOR V46T0				DRAIN LINE (TEMPERATURE
LEAD ANALYST	: J. B	ARNES			
ASSESSMENT:					
F	CICALITY CLIGHT DW/FUNC	REDUN	DANCY SCR B	EENS C	CIL ITEM
NASA [3 IOA [3	/3] /1R]	[NA] [P]	[NA] [P]	[NA] [F]	[x] *
COMPARE [/N]	[N]	[N]	[N]	[N]
RECOMMENDATI	ons: (I	f differe	nt from N	ASA)	·
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TOW CONCORD	MITTU NADA	WINNIDTO	•		

ASSESSMEN ASSESSMEN NASA FME	NT ID:	APU-4	L4X	-2				ASA DATA BASELINE NEW		
SUBSYSTEM MDAC ID: ITEM:		APU 414 FUEL	LINE	TEMP	ERATU	JRE SI	ensoi	R V46T01	04A	(204,304)
LEAD ANA	LYST:	J. BAI	RNES							
ASSESSME	NT:									
(CRITICAL FLIGH		RI	EDUNDA	ANCY	SCRE	ENS		CII	
	HDW/FU		A		В		С			
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COMPARE	[/	1	[]	E]	[1	[]
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REMARKS:										

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:	E: 12/10 APU-4 04-2-	15X	-2			ASA DATA BASELINE NEW	[c]	
SUBSYSTEM: MDAC ID: ITEM:	APU 415 FUEL	LINE	TEME	PERATUR	E SENSO	R V46T01	08A	(208,308))
LEAD ANALYST:	J. BA	RNES							
ASSESSMENT:								,	
CRITICA FLIC HDW/I	HT	Ri A		DANCY S	CREENS C		CII ITI		
NASA [3 /2 IOA [3 /2	R]	[P]	[P] [P]	[P]	[] *]	
COMPARE [/]	[]	[]	[]	[]	
RECOMMENDATIONS	: (If	dif	feren	nt from	NASA)				
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* CIL RETENTION REMARKS:	RATION	ALE:	(If	applic	A.	DEQUATE DEQUATE	[]	

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LEAD AN	-	ST	:	J.	BA	RN:	ES													
ASSESSMI	ENT	:																		
		F	ICAL: LIGH: W/FUI	r	Z		RI A	EDUNI	DAN	CY B	sc	REE	NS	c			C]	L EM	ſ	
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RECOMME	NDA'	TI	ons:		(If	đ.	if	fere	nt	fr	om	NAS.	A)							
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ASSESSME ASSESSME NASA FME	NT	I	D:	12/1 APU- NONE										DATA ELINI NEV		[]	
SUBSYSTE MDAC ID: ITEM: V46T0128		(2		APU 417 FUEL 28)	PUN	ſΡ	вур	ASS	L	Ine	TEM	PE:	RATI	URE S	SENSC)R	
LEAD ANA	LY	ST	:	J. B	ARNI	ES											
ASSESSME	NT	:															
		F	LIGH!	ITY I NC		RI A	EDUN	DAN	CY B	SC	REEN	s c			CII		
NASA IOA]	3	/ /2R]]	P]	[P]	[P]		[]	*
COMPARE	[N	/N]	[N]	[N]	Į.	N]		C]	
RECOMMEN	DA'	ri	ons:	(I:	f di	fı	fere	nt	fro	om 1	NASA)					
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ASSESSMENT NASA FMEA	ID:	APU-418 04-2-C	3 X	7-12				BASELIN NE	E	[[x]	
SUBSYSTEM: MDAC ID: ITEM:		APU 418 CONTROI	LLER	GG I	NJE(CTOR (coc	LING CON	ITR	OL		
LEAD ANALY	ST:	J. BAR	NES									
ASSESSMENT	:											
CR	ITICAL:		RE	DUNDA	NCY	SCREE	ens	}		CIL ITE		
	HDW/FUI	1C	A	С								
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COMPARE [/]	[]	[]	[]		C]	
RECOMMENDA	TIONS:	(If o	liff	erent	fr.	om NAS	SA)					
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REMARKS:	יידע פ	NACA AI	\T&T. V	STS			IN	IADEQUATE	S	[J	

ASSESSMENT DAT ASSESSMENT ID: NASA FMEA #:	APU-419			NASA DATA BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	APU 419 CONTROL	LER SECC	NDARY SF	PEED CONTROL	
LEAD ANALYST:	J. BARN	ES			
ASSESSMENT:					
CRITIC FLI HDW/	GHT FUNC	A	NCY SCRE	С	CIL ITEM
NASA [1 / IOA [1 /	1] [1] [NA] NA]	[NA] [NA]	[NA] [NA]	[X] * [X]
COMPARE [/] []	[]	[]	[]
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* CIL RETENTIO REMARKS:	N RATIONALI	E: (If a	pplicabl	e) ADEQUATE INADEQUATE	

IOA CONCURS WITH NASA ANALYSIS.

ASSESSME ASSESSME NASA FME	NT I	D:	8/04/ APU-4 05-6N	20X	3-1				ASA DA' BASELII N		x]	
SUBSYSTEMDAC ID:	M:		APU 420 LUBE	OIL	LINE	HEAT	ER SW	ITCH	POWER	FUS	E		
LEAD ANA	LYSI	r:	J. BA	RNES									
ASSESSME	NT:												
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LEAD ANALYST:	J. BARNES				
ASSESSMENT:					
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LEAD ANALYST:	J. BARNES											
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SUBSYSTEM:	APU 435	HEATER GSE DRIVER	DIODE
LEAD ANALYST:	J. BARNES		
ASSESSMENT:			
CRITICAL: FLIGH: HDW/FUI		ANCY SCREENS B C	CIL ITEM
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MDAC ID:	APU 436 GAS GEN/FUEI	DUMP HEATER	SWITCH DIO	DE - CR1,
LEAD ANALYST:	J. BARNES			
ASSESSMENT:				
CRITICAL: FLIGH HDW/FU	r · ·	INDANCY SCREEN B	is C	CIL ITEM
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SUBSYSTE MDAC ID: ITEM: DIODE		APU 438 GAS	GEN/FUEL	PUMP HEA	TER GROUND (COMMAND DRIVER
LEAD ANA	LYST:	J. B	ARNES			
ASSESSME	NT:					
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SUBSYSTEM: MDAC ID: ITEM:	APU 439 GAS GEN HEAT	ER DRIVER		
LEAD ANALYST:	J. BARNES			
ASSESSMENT:				
CRITICAL FLIGH HDW/FU	T	NDANCY SCREI B	ens C	CIL ITEM
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LEAD ANALYST:	J. BARNES			
ASSESSMENT:				
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SUBSYSTEM: MDAC ID: ITEM:	APU 441 LUBE OIL LINE	HEATER SWITCH	POWER DIODE-CR2
LEAD ANALYST:	J. BARNES		
ASSESSMENT:			
CRITICAL: FLIGHT HDW/FUI	r ·	DANCY SCREENS B C	CIL ITEM
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SUBSYSTEM: MDAC ID: ITEM:	APU 442 LUBE OIL LINE	HEATER SWITCH	POWER RESISTOR
LEAD ANALYST:	J. BARNES		
ASSESSMENT:			
CRITICAL: FLIGHT . HDW/FU	ľ	DANCY SCREENS B C	CIL ITEM
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APPENDIX D

CRITICAL ITEMS

APPENDIX D POTENTIAL CRITICAL ITEMS

NASA FMEA	MDAC-ID	ITEM	FAILURE MODE
04-2-CFH02-1	239	INJECTOR COOLING H2O LINE FLEX HOSE	EXTERNAL LEAK, RESTRICTED FLOW
04-2-CL01-1	184	FUEL PUMP SEAL CAVITY DRAIN COLLECTOR	LEAKAGE
04-2-CL03-1	233	INJECTOR COOLING H ₂ O LINE AND FITTINGS UPSTREAM OF VALVE	LEAKAGE
04-2-CL03-2	234	INJECTOR COOLING H2O LINE AND FITTINGS	RESTRICTED FLOW
04-2-CL1A-11	178	FUEL PUMP SEAL CAVITY DRAIN FLEX HOSE	EXTERNAL LEAK
04-2-CLV13-2	224	INJECTOR COOLING VALVE	STUCK OPEN, EXTERNAL LEAK
04-2-CONTL1-12	383	CONTROLLER PRIMARY SPEED CONTROL	PREMATURE OUTPUT
04-2-CONTL2-11	384	CONTROLLER HIGH SPEED CONTROL	LOSS OF OUTPUT
04-2-CONTL2-12	419	CONTROLLER HIGH SPEED CONTROL	PREMATURE OUTPUT (INADVERTENT HOT RESTART)
04-2-CONTL5-1	379	CONTROLLER SAFETY MONITORING	LOSS OF OUTPUT
04-2-CONTL5-12	380	CONTROLLER SAFETY MONITORING	PREMATURE OUTPUT
04-2-CONTL6-1	390	CONTROLLER GEARBOX PRESSURE CONTROL	LOSS OF OUTPUT
04-2-CONTL7-12	418	CONTROLLER INJECTOR COOLING CONTROL	PREMATURE APU START COMMAND
04-2-CTK01-1	230	INJECTOR COOLING H2O TANK	DIAPHRAGM LEAK
04-2-CTK01-2	229	INJECTOR COOLING H2O TANK	EXTERNAL LEAK
04-2-FBRV01-1	216	LUBE OIL FILTER BYPASS RELIEF VALVE	FAILS CLOSED
04-2-FL11-11	174	FUEL IN-LINE FILTER	BLOCKAGE
04-2-FL12-11	136	FUEL PUMP FILTER	BLOCKAGE
04-2-FL12-12	137	FUEL PUMP FILTER	FAILS TO FILTER
04-2-GG11-11	100	GAS GENERATOR	FAILS TO FUNCTION
04-2-GG11-2	101	GAS GENERATOR	LEAKAGE
04-2-GT11-2	195	GEARBOX	LOSS OF PRESSURIZATION

NASA FMEA	MDAC-ID	ITEM	FAILURE MODE
04-2-GT11-11	106	GEARBOX	LOSS OF OUTPUT
04-2-HR116-11		FUEL LINE HEATER	
04-2-L1-11		FUEL LINE-UPSTREAM	
04-2-L1-11		FUEL LINE-DOWNSTREAM	
04-2-L1-11			
		FUEL LINE FLEX HOSE	
		LUBE OIL LINES	
04-2-L2A-11	198	LUBE OIL LINE	
	170	FLEX HOSE	44412.24
04-2-L3-11	119		LEAK
04-2-L4-11		EXHAUST DUCT	LEAK
04-2-LV11-10	125	FUEL TANK ISOL VLVE	
04-2-LV11-10	126	FUEL TANK ISOL VLV	EXTERNAL LEAK
04-2-LV12-1	140	PRIMARY FUEL VALVE	FAILS TO OPEN
04-2-LV12-1		PRIMARY FUEL VALVE	INTERNAL LEAK
04-2-LV12-2	139	PRIMARY FUEL VALVE	FAILS TO CLOSE
04-2-1.V12-2	141	PRIMARY FUEL VALVE	INTERNAL LEAK
04-2-LV13-1	146	SECONDARY FUEL VLV	FAILS OPEN
04-2-LV13-1	147	SECONDARY FUEL VLV	FAILS MID-POSITION
04-2-LV13-1	148	SECONDARY FUEL VLV	INTERNAL LEAK
04-2-LV13-2		SECONDARY FUEL VLV	FAILS TO OPEN
04-2-LV13-2	149	SECONDARY FUEL VLV	INTERNAL LEAK
04-2-LV14-1	192	GEARBOX PRESS VLV	
04-2-MD11-13	153	FUEL TANK HYDRAZINE	
04-2-MD11-13	133	FILL Q.D.	EXIEMNAL DEAK
04-2-MD12-13	120	FUEL TANK GN2 FILL	EXTERNAL LEAK
04 2 11512 15		Q.D.	DAILIGAD DDAK
04-2-MD13-13	158	FUEL LINE HI POINT	EXTERNAL LEAK
04 Z MD13 13	150	BLEED Q.D.	EXIEMAD DEAK
04-2-MD14-13	199	GEARBOX FILL Q.D.	FYTEDNAT, T.FAK
04-2-MD14-13	201	GEARBOX HIGH POINT	
04 2 11014 13	201	BLEED Q.D.	DAIDIGNAD BEAR
04-2-MD14-13	204	GEARBOX LOW POINT	EXTERNAL LEAK
04 2 11514 15	204	DRAIN Q.D.	DATERNAD DEAR
04-2-MPU1-11	112	MAGNETIC PICKUP	NO OUTPUT
04-2-MPU2-1	113	MAGNETIC PICKUP	NO OUTPUT
04-2-PP11-10	128	FUEL PUMP	INTERNAL LEAK
04-2-PP11-11	129	FUEL PUMP	EXTERNAL LEAK
04-2-PP11-11	130	FUEL PUMP	NO OUTPUT
04-2-PP11-11	131	FUEL PUMP BYPASS VLV	
04-2-PP11-11	133	FUEL PUMP RELIEF VLV	
	200	TODE TOTAL NEEDLE VEV	PRESSURE
04-2-PP11-11	135	FUEL PUMP RELIEF VLV	
04-2-PP11-3	132	FUEL PUMP BYPASS VLV	
04-2-PP12-11	187	LUBE OIL PUMP	NO OUTPUT
04-2-S112A-2	170	FUEL PUMP SEAL	FAIL CLOSED
or a prient	2.0	DRAIN LINE	
		THERMOSTAT	
04-2-S14A-2	167	FUEL LINE HEATER	FAIL CLOSED
		THERMOSTAT	IAIL CLOSED
04-2-S16A-1	164	FUEL LINE HEATER	FAIL OPEN
or a proper		THERMOSTAT	TALL VEEN
		IIIIIIIIIIIII	

NASA FMEA	MDAC-ID	ITEM	FAILURE MODE
04-2-S16A-2	165	FUEL LINE HEATER THERMOSTAT	FAIL CLOSED
04-2-S17A-2	173	FUEL PUMP/VALVE HTR THERMOSTAT	FAIL CLOSED
04-2-TH11-11	276	EXHAUST PLENUM HOUSING	EXTERNAL LEAK
04-2-TK11-11	115	FUEL TANK	RUPTURE AT OPERATING PRESS.
04-2-TK11-11	116	FUEL TANK	EXTERNAL LEAK
	117		EXTERNAL LEAK
04-2-TK11-12		FUEL TANK	INTERNAL LEAK
04-2-TP11-13		FUEL TANK FUEL LINE TEST Q.D.	EXTERNAL LEAK
04-2-TR11-11		TURBINE WHEEL	LOSS OF OUTPUT
04-2-TR12-1	102	TURBINE WHEEL	
04-2-V12-13-1	143	DRIMARY FILET, VALVE	TNTERNAT, LEAK
04-2-V12-13-1	144	DOTMADV FIIFT, WATWE	FYTEDNAT, TEAK
04-2-V12-13-1	150	SECONDARY FUEL VLV	EXTERNAL LEAK
05-6N-2013-1	314	SECONDARY FUEL VLV FUEL TANK VALVE SW	FAIL TO CLOSE
05-6N-2013-1	315	FUEL TANK VALVE SW	FAIL TO REMAIN CLOSED
05-6N-2013-2	316	FUEL TANK VALVE SW	FAIL TO OPEN
05-6N-2013-2	317	FUEL TANK VALVE SW FUEL TANK VALVE SW	INADVERTENT
			OPERATION
05-6N-2014-2	319	FUEL TANK VLV DRIVER	FAIL ON
05-6N-2014-2	409	FUEL TANK VLV DRIVER	FAIL ON
05-6N-2015-2	421	FUEL TANK VALVE CIRCUIT BREAKER	FAIL CLOSED
05-6N-2016-1	288	"APU CNTLR PWR" SW	FAIL TO CLOSE
05-6N-2016-1	289	"APU CNTLR PWR" SW	FAIL TO REMAIN CLOSED
05-6N-2016-2	290	"APU CNTLR PWR" SW	FAIL TO OPEN
05-6N-2016-2	291	"APU CNTLR PWR" SW	INADVERTENT OPERATION
05-6N-2017-2	293	CONTROLLER POWER	FAIL CLOSED
05-6N-2018-1	294	CNTLR POWER DIODE	FAIL OPEN
05-6N-2018-2	422	CNTLR POWER DIODE	INTERNAL SHORT
05-6N-2022-1	323	FUEL TANK VLV DIODE	FAIL OPEN
05-6N-2022-2	423	FUEL TANK VLV DIODE	INTERNAL SHORT
05-6N-2025-2	424	FUEL TANK VLV DIODE	INTERNAL SHORT
05-6N-2026-1	425	FUEL TANK VALVE RESISTOR	FAIL OPEN
05-6N-2029-1	320	FUEL TANK VLV DRIVER	FAIL OFF
05-6N-2030-1	426	FUEL TANK VLV DIODE	FAIL OPEN
05-6N-2030A-1	427	FUEL TANK VALVE FUSE	FAIL OPEN
05-6N-2033-2	428	CNTLR POWER DIODE	INTERNAL SHORT
05-6N-2034-1	286	APU CNTLR CRCT FUSE	FAIL OPEN
05-6N-2035-1	280	"APU CONTROL" SW	FAIL TO CLOSE
05-6N-2035-1	281	"APU CONTROL" SW	FAIL TO REMAIN CLOSED
05-6N-2035-2	282	"APU CONTROL" SW	FAIL TO OPEN
05-6N-2035-2	406	"APU CONTROL" SW	INADVERTENT START
05-6N-2036-2	429	APU CNTLR SW DIODE	INTERNAL SHORT

NASA FMEA	MDAC-ID	ITEM	FAILURE MODE
05-6N-2037-2	430	APU CONTROL CIRC PUMP INH DIODE	INTERNAL SHORT
05-6N-2040-1	309	AUTO SHTDWN SW FUSE	FATI, OPEN
05-6N-2042-1	305	"APU AUTO SHTDWN" SW	FAIL TO CLOSE
05-6N-2042-1	306	"APU AUTO SHUTDOWN" SWITCH	FAIL TO REMAIN
05-6N-2042-2	307	"APU AUTO SHTDWN" SW	FAIL TO OPEN
05-6N-2042-2	308	"APU AUTO SHTDWN" SW "APU AUTO SHUTDOWN" SWITCH	INADVERTENT OPERATION
05-6N-2043-1	420	LUBE OIL LINE HEATER FUSE	FAIL OPEN
05-6N-2044-2	442	LUBE OIL LINE HEATER RESISTOR	INTERNAL SHORT
05-6N-2045-1	431	LUBE OIL LINE HEATER DIODE	FAIL OPEN
05-6N-2045-2	441	LUBE OIL LINE HEATER DIODE	INTERNAL SHORT
05-6N-2047-1	357	LUBE OIL LINE HTR SW	FAIL TO CLOSE
05-6N-2048-2		LUBE OIL LINE HTR SW LUBE OIL LINE HTR DIODE	INTERNAL SHORT
05-6N-2050-2	433	HTR DIODE LUBE OIL LINE HEATER DIODE	INTERNAL SHORT
05-6N-2051-2	361	LUBE OIL LINE HEATER DRIVER	
05-6N-2055-1	348	FUEL HEATER SW	FAIL TO CLOSE
05-6N-2055-2	349		FAIL TO OPEN
05-6N-2056-2	434	TANK/FUEL LINE HTR DIODE	INTERNAL SHORT
05-6N-2057-2	435	TANK/FUEL LINE HTR DIODE	INTERNAL SHORT
05-6N-2059-2	351	FUEL/H20 HEATER DRIVER	CIRCUIT DRIVER FAIL ON
05-6N-2059-A2	352	FUEL/H2O HEATER DRIVER	
05-6N-2061-2	443	GAS GENERATOR/FUEL HEATER RESISTOR	INTERNAL SHORT
05-6N-2063-1	436	GAS GEN/FUEL PUMP HEATER DIODE	FAIL OPEN
05-6N-2064-1	353	GAS GEN/FUEL PUMP HEATER SW	FAIL TO CLOSE
05-6N-2064-2	354	GAS GEN/FUEL PUMP HEATER SW	FAIL TO OPEN
05-6N-2065-2	437	GAS GEN/FUEL PUMP HEATER DIODE	INTERNAL SHORT
05-6N-2066-2	438	GAS GEN/FUEL PUMP HEATER DIODE	INTERNAL SHORT
05-6N-2073-2	439	GAS GEN HEATER DRIVER	FAIL ON
05-6N-2074-2	356	GAS GEN/FUEL PUMP HEATER DRIVER	CIRCUIT DRIVER FAIL ON
05-6N-2074A-2	440	FUEL PUMP/LINE HEATER DRIVER	FAIL ON

APPENDIX E DETAILED ANALYSIS

This appendix contains the IOA analysis worksheets supplementing previous results reported in STSEOS Working Paper 1.0-WP-VA86001-014, Analysis of the Auxiliary Power Unit, (12 December 1986). Prior results were obtained independently and documented before starting the FMEA/CIL assessment activity. Supplemental analysis was performed to address failure modes not previously considered by the IOA. Each sheet identifies the hardware item being analyzed, parent assembly and function performed. For each failure mode possible causes are identified, and hardware and functional criticality for each mission phase are determined as described in NSTS 22206, Instructions for Preparation of FMEA and CIL, 10 October 1986. Failure mode effects are described at the bottom of each sheet and worst case criticality is identified at the top.

LEGEND FOR IOA ANALYSIS WORKSHEETS

Hardware Criticalities:

- 1 = Loss of life or vehicle
- 2 = Loss of mission or next failure of any redundant item (like or unlike) could cause loss of life/vehicle
- 3 = All others

Functional Criticalities:

- 1R = Redundant hardware items (like or unlike) all of which,
 if failed, could cause loss of life or vehicle.
- 2R = Redundant hardware items (like or unlike) all of which, if failed, could cause loss of mission.

Redundancy Screen A:

- 1 = Is Checked Out PreFlight
- 2 = Is Capable of Check Out PreFlight
- 3 = Not Capable of Check Out PreFlight
- NA = Not Applicable

Redundancy Screens B and C:

- P = Passed Screen
- F = Failed Screen
- NA = Not Applicable

DATE:

12/22/86

HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: APU

FLIGHT:

3/1R

MDAC ID: 401

ABORT:

3/1R

ITEM:

FUEL LINE HEATER

FAILURE MODE: FAIL OFF, OR LOW OUTPUT

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) FUEL SYSTEM
- 3) FUEL LINE HEATER

4)

5)

6)

7)

8)

9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/1R	AOA:	3/3
DEORBIT:	3/1R	ATO:	3/1R
LANDING/SAFING:	3/1R ·		,

REDUNDANCY SCREENS: A [1] B [NA] C [P]

LOCATION: AFT COMPARTMENT

PART NUMBER: MC363-0026-0016

CAUSES: BROKEN WIRE, THERMOSTAT FAILED OPEN, SHORT CIRCUIT,

INSTALLATION ERROR

EFFECTS/RATIONALE:

LOSS OF REDUNDANCY FOR HEATING FUEL LINES. IF BOTH HEATERS ARE LOST, FUEL CAN FREEZE AND APU MAY BE LOST. CRITICALITY IS 3/1R FOR DEORBIT: 2 FAILURES AWAY FROM CRITICAL (1 MORE HEATER AND 1 MORE APU).

DATE: 12/23/86 HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: APU FLIGHT: 3/1R 402 MDAC ID: 3/1R ABORT:

ITEM: FUEL VALVE HEATER

FAILURE MODE: FAIL OFF, OR LOW OUTPUT

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) FUEL SYSTEM
- 3) FUEL VALVE HEATER
- 4)
- 5)
- 6)
- 7) 8)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/1R	AOA:	3/3
DEORBIT:	3/1R ·	ATO:	3/1R
LANDING/SAFING:	3/1R		•

REDUNDANCY SCREENS: A [1] B [NA] C [P]

LOCATION: AFT COMPARTMENT

PART NUMBER: MC201-0001

CAUSES: BROKEN WIRE, THERMOSTAT FAILED OPEN, SHORT CIRCUIT, INSTALLATION ERROR

EFFECTS/RATIONALE:

LOSS OF REDUNDANCY FOR HEATING FUEL VALVES. IF BOTH HEATERS ARE LOST, FUEL CAN FREEZE AND APU MAY BE LOST. CRITICALITY IS 3/1R FOR DEORBIT: 2 FAILURES AWAY FROM CRITICAL (1 MORE HEATER AND 1 MORE APU).

DATE: 12/29/86 HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: APU FLIGHT: 2/1R MDAC ID: 403 ABORT: 1/1

ITEM: GEARBOX FILL, VENT, AND DRAIN COUPLINGS

FAILURE MODE: FAILS OPEN

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) LUBE OIL SYSTEM
- 3) LUBE OIL LINES
- 4) GEARBOX FILL, VENT, AND DRAIN COUPLINGS

5)

6)

7)

8)

9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	1/1
LIFTOFF:	2/1R	TAL:	1/1
ONORBIT:	2/1R	AOA:	1/1
DEORBIT:	2/1R	ATO:	1/1
LANDING/SAFING:	2/1R		•

REDUNDANCY SCREENS: A [1] B [P] C [P]

LOCATION: AFT COMPARTMENT PART NUMBER: MC621-0038-0500

CAUSES: CORROSION, CONTAMINATION, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:

1) LOSS OF LUBE OIL. 2) LOSS OF APU DUE TO GEARBOX FAILURE. CRITICALITY IS 2/1R DUE TO LOSS OF APU. ABORT: CRITICALITY IS 1/1 FOR ENGINE-OUT ABORTS DUE TO POSSIBLE LOSS OF ANOTHER MAIN ENGINE.

DATE: 12/30/86 HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: APU FLIGHT: 3/1R MDAC ID: 404 ABORT: 3/1R

ITEM: INJECTOR COOLING WATER TANK HEATER

FAILURE MODE: SHORT CIRCUIT

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) INJECTOR COOLING SYSTEM
- 3) WATER TANK HEATER
- 4)
- 5)
- 6)
- 7)
- 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/3	AOA:	3/3
DEORBIT:	3/1R	ATO:	3/1R
LANDING/SAFING:	3/3		•

REDUNDANCY SCREENS: A [1] B [NA] C [P]

LOCATION: AFT COMPARTMENT PART NUMBER: MC363-0025-0002

CAUSES: CONTAMINATION, CORROSION

EFFECTS/RATIONALE:

LOSS OF REDUNDANCY FOR HEATING INJECTOR COOLING WATER TANK. IF BOTH HEATERS ARE LOST, WATER WILL FREEZE, AND INJECTOR COOLING WILL BE LOST. CRITICALITY IS 3/1R FOR DEORBIT BEFORE APU COOLDOWN. APU STARTED HOT COULD CAUSE FUEL TO DETONATE.

DATE:

12/31/86

HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: APU

FLIGHT:

3/1R

MDAC ID:

405

ABORT:

3/1R

ITEM:

FUEL PUMP/GGVM COOLING WATER TANK HEATER

FAILURE MODE: SHORT CIRCUIT

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- APU 1)
- FUEL PUMP/GGVM COOLING SYSTEM 2)
- WATER TANK HEATER

4)

5)

6)

7) 8)

9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC	
PRELAUNCH:	3/3	RTLS:	3/3	
LIFTOFF:	3/3	TAL:	3/3	
ONORBIT:	3/3	AOA:	3/3	
DEORBIT:	3/1R	ATO:	3/1R	
LANDING/SAFING:	3/3		·	

REDUNDANCY SCREENS: A [1] B [NA] C [P]

LOCATION: AFT COMPARTMENT

PART NUMBER: MC363-0025-0002

CAUSES: CONTAMINATION, CORROSION

EFFECTS/RATIONALE:

LOSS OF HEATER REDUNDANCY FOR ONE SYSTEM WATER TANK. IF THE OTHER HEATER SET IS LOST, THE WATER TANK CAN FREEZE, CAUSING LOSS OF FUEL PUMP/GGVM COOLING REDUNDANCY. CRITICALITY IS 3/1R FOR DEORBIT BEFORE APU COOLDOWN. APU STARTED HOT CAN CAUSE FUEL TO DETONATE.

DATE: 1/06/87 HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: APU FLIGHT: 3/3 3/3 MDAC ID: 406 ABORT:

"APU CONTROL" SWITCH ITEM:

FAILURE MODE: INADVERTENT START/OVERRIDE COMMAND

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- ELECTRICAL SYSTEM 2)
- 3) APU CONTROL CIRCUIT
- 4) "APU CONTROL" SWITCH
- 5)
- 6)
- 7)
- 8)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	/NA
LIFTOFF:	/NA	TAL:	/NA
ONORBIT:	3/3	AOA:	/NA
DEORBIT:	3/3	ATO:	3/3
LANDING/SAFING	: 3/3	•	-

REDUNDANCY SCREENS: A [NA] B [NA] C [NA]

LOCATION: PANEL R2

PART NUMBER:

CAUSES: VIBRATION, CONTAMINATION (SHORT)

EFFECTS/RATIONALE:

NO EFFECT - APU FUEL TANK VALVES WILL PREVENT FUEL FROM REACHING GAS GENERATOR.

HIGHEST CRITICALITY HDW/FUNC DATE: 1/06/87

FLIGHT: SUBSYSTEM: APU 3/3 ABORT: 3/3 MDAC ID: 407

CONTROLLER POWER CIRCUIT CONTROL INPUT DIODE ITEM:

FAILURE MODE: INTERNAL SHORT

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) ELECTRICAL SYSTEM
- 3) CONTROLLER POWER CIRCUIT
- 4) CONTROL DIODE
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/3	AOA:	3/3
DEORBIT:	3/3	·ATO:	3/3
LANDING/SAFING:	3/3 .		•

REDUNDANCY SCREENS: A [NA] B [NA] C [NA]

LOCATION: AV BAY 4, 5, 6 (AFT PCA 4, 5, 6)

PART NUMBER:

CAUSES: CONTAMINATION, MANUFACTURING DEFECT

EFFECTS/RATIONALE:

NO EFFECT, DUE TO DIODES IN SERIES WITHIN THE CONTROLLER.

1/08/87 HIGHEST CRITICALITY HDW/FUNC DATE:

FLIGHT: SUBSYSTEM: APU 3/1R MDAC ID: 408 ABORT: 2/1R

ITEM: FUEL TANK VALVE DRIVER - APU 2,3

FAILURE MODE: FAIL OFF, OR SHORT TO GROUND

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) ELECTRICAL SYSTEM
- 3) FUEL TANK VALVE CONTROL CIRCUIT
- 4) CIRCUIT DRIVER
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

HDW/FUNC	ABORT	HDW/FUNC
3/3	RTLS:	2/1R
3/1R	TAL:	2/1R
3/3	AOA:	2/1R
3/1R	ATO:	2/1R
3/1R	•	•
	3/3 3/1R 3/3 3/1R	3/3 RTLS: 3/1R TAL: 3/3 AOA: 3/1R ATO:

REDUNDANCY SCREENS: A [1] B [P] C [P]

LOCATION: AFT LCA 1, 2, 3 PART NUMBER: MC477-0261-0002

CAUSES: MANUFACTURING DEFECT, VIBRATION, CONTAMINATION

EFFECTS/RATIONALE:

LOSS OF REDUNDANT FUEL TANK VALVE; OTHER VALVE ALLOWS APU TO OPERATE. CRITICALITY IS 3/1R DUE TO VALVE AND APU REDUNDANCY. ABORT: CRITICALITY IS 2/1R FOR ENGINE-OUT ABORTS, WHERE LOSS OF ONE APU CAN BE CRITICAL.

HIGHEST CRITICALITY HDW/FUNC DATE: 1/08/87

FLIGHT: 3/1R SUBSYSTEM: APU 3/1R ABORT: MDAC ID: 409

FUEL TANK VALVE CIRCUIT DRIVER - APU 2,3 ITEM:

FAILURE MODE: FAIL ON

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) ELECTRICAL SYSTEM
- 3) FUEL TANK VALVE CONTROL CIRCUIT
- CIRCUIT DRIVER 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

DITCHM DUACE	HDW/FUNC	ABORT	HDW/FUNC
FLIGHT PHASE			•
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/3	AOA:	3/3
DEORBIT:	3/1R	ATO:	3/1R
LANDING/SAFING:	3/3	•	

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION: AFT LCA 1, 2, 3 PART NUMBER: MC477-0261-0002

CAUSES: CONTAMINATION, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:

NO EFFECT, DUE TO TWO OTHER CIRCUIT DRIVERS IN SERIES. IF ALL 3 DRIVERS FAILED ON, VALVE COULD OVERHEAT AND DETONATE FUEL (FIRE HAZARD DURING ENTRY). CRITICALITY IS 3/1R: 2 FAILURES AWAY FROM CRITICALITY 1.

DATE: 1/08/87 HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: APU FLIGHT: 2/1R MDAC ID: 410 ABORT: 2/1R

ITEM: "PUMP/VLV COOL" SWITCH

FAILURE MODE: SHORTS TO GROUND, SHORTS POLE-TO-POLE

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) ELECTRICAL SYSTEM
- 3) FUEL PUMP/GGVM COOLING CONTROL CIRCUIT
- 4) "PUMP/VLV COOL" SWITCH
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/3	AOA:	3/3
DEORBIT:	2/1R	ATO:	2/1R
LANDING/SAFING:	3/3		·

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION: PANEL R2

PART NUMBER: ME452-0102-7301

CAUSES: CONTAMINATION, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:

LOSS OF ONE OF TWO FUEL PUMP/GGVM COOLING SYSTEMS. CRITICALITY IS 2/1R FOR DEORBIT BEFORE APU COOLDOWN. APU STARTED HOT CAN CAUSE FUEL TO DETONATE.

HIGHEST CRITICALITY HDW/FUNC 1/12/87 DATE:

FLIGHT: 3/1R SUBSYSTEM: APU ABORT: 3/1R MDAC ID: 411

FUEL PUMP/GGVM COOLING CONTROL CIRCUIT TIMIMG ITEM:

DRIVER

FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) ELECTRICAL SYSTEM
- 3) FUEL PUMP/GGVM COOLING CONTROL CIRCUIT

4) TIMING DRIVER

5)

6)

7)

8) 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
· ONORBIT:	3/3	AOA:	3/3
DEORBIT:	3/1R	ATO:	3/1R
LANDING/SAFING:	•		•

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION: APU TIMER BOX 1, 2, 3

PART NUMBER: MC477-0262-0002

CAUSES: MANUFACTURING DEFECT, PIECE-PART MECHANICAL FAILURE

EFFECTS/RATIONALE:

WORST CASE EFFECT IS LOSS OF REDUNDANT POWER TO ONE APU COOLING VALVE. CRITICALITY IS 3/1R FOR DEORBIT BEFORE APU COOLDOWN. APU STARTED HOT CAN CAUSE FUEL TO DETONATE.

HIGHEST CRITICALITY HDW/FUNC DATE: 12/31/86

FLIGHT: SUBSYSTEM: APU 3/1R 3/1R MDAC ID: 412 ABORT:

ITEM: FUEL TEST LINE TEMPERATURE SENSOR V46T0183A

(283,383) V46T0184A (284,384)

FAILURE MODE: NO OUTPUT

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) INSTRUMENTATION
- 3) FUEL TEST LINE TEMPERATURE SENSOR
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3.
ONORBIT:	3/1R	AOA:	3/3
DEORBIT:	3/1R	ATO:	3/1R
LANDING/SAFING:	3/1R		•

REDUNDANCY SCREENS: A [2] B [P] C [F]

AFT COMPARTMENT LOCATION: PART NUMBER: ME449-0160-0003

CAUSES: MANUFACTURING DEFECT, PIECE-PART STRUCTURAL FAILURE, VIBRATION, MECHANICAL SHOCK, CONTAMINATION, HANDLING DAMAGE

EFFECTS/RATIONALE:

WITH NO TEMPERATURE SENSING, A FAILED-ON HEATER CAN CAUSE FUEL DETONATION AND FIRE HAZARD. CRITICALITY IS 3/1R (HEATER FAILED ON + 2 SENSORS FAILED = CRITICAL).

HIGHEST CRITICALITY HDW/FUNC DATE: 12/31/86

3/1R SUBSYSTEM: APU FLIGHT: ABORT: 3/1R MDAC ID: 413

FUEL PUMP SEAL CAVITY DRAIN LINE TEMPERATURE ITEM:

SENSOR V46T0186A (286,386) V46T0170A (270,370)

FAILURE MODE: NO OUTPUT

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- INSTRUMENTATION 2)
- FUEL PUMP SEAL CAVITY DRAIN LINE TEMPERATURE SENSOR 3)

4)

5)

6)

7)

8) 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/1R	AOA:	3/3
DEORBIT:	3/1R	ATO:	3/1R
LANDING/SAFING	: 3/1R		•

REDUNDANCY SCREENS: A [2] B [P] C [F]

LOCATION: AFT COMPARTMENT PART NUMBER: ME449-0160-0003

CAUSES: MANUFACTURING DEFECT, PIECE-PART STRUCTURAL FAILURE, VIBRATION, MECHANICAL SHOCK, CONTAMINATION, HANDLING DAMAGE

EFFECTS/RATIONALE:

WITH NO TEMPERATURE SENSING, AND FUEL IN THE LINE FROM A FUEL PUMP SEAL LEAK, A FAILED-ON HEATER CAN CAUSE FUEL DETONATION AND FIRE HAZARD. CRITICALITY IS 3/1R (FUEL PUMP SEAL LEAK + HEATER FAILED ON + 2 SENSORS FAILED = CRITICAL).

HIGHEST CRITICALITY HDW/FUNC DATE: 1/05/87

SUBSYSTEM: APU FLIGHT: 3/2R MDAC ID: 414 ABORT: 3/3

ITEM: FUEL LINE TEMPERATURE SENSOR V46T0104A (204,304)

FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- INSTRUMENTATION 2)
- 3) FUEL LINE TEMPERATURE SENSOR 1
- 4)
- 5)
- 6) 7)
- 8)
- 9)

CRITICALITIES

HDW/FUNC	ABORT	HDW/FUNC	
3/3	RTLS:	3/3	
3/3	TAL:	3/3	
3/2R	AOA:	3/3	
3/3	ATO:	3/3	
3/3		•	
	3/3 3/3 3/2R 3/3	3/3 RTLS: 3/3 TAL: 3/2R AOA: 3/3 ATO:	

REDUNDANCY SCREENS: A [1] B [P] C [P]

LOCATION: AFT COMPARTMENT PART NUMBER: ME449-0160-0003

CAUSES: MANUFACTURING DEFECT, PIECE-PART STRUCTURAL FAILURE, VIBRATION, MECHANICAL SHOCK, CONTAMINATION, HANDLING DAMAGE

EFFECTS/RATIONALE:

LOSS OF REDUNDANCY FOR MONITORING OF HEATER STATUS. IF BOTH SENSORS ARE LOST, MISSION MAY BE TERMINATED EARLY.

DATE:

1/05/87

HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: APU

FLIGHT:

3/2R

MDAC ID: 415

ABORT:

3/3

ITEM:

FUEL LINE TEMPERATURE SENSOR V46T0108A (208,308)

FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- INSTRUMENTATION 2)
- FUEL LINE TEMPERATURE SENSOR 2 3)

4)

5)

6)

7)

8) 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/2R	AOA:	3/3
DEORBIT:	3/3	ATO:	3/3
LANDING/SAFING	: 3/3		

REDUNDANCY SCREENS: A [1] B [P] C [P]

LOCATION:

AFT COMPARTMENT

PART NUMBER: ME449-0160-0003

CAUSES: MANUFACTURING DEFECT, PIECE-PART STRUCTURAL FAILURE, VIBRATION, MECHANICAL SHOCK, CONTAMINATION, HANDLING DAMAGE

EFFECTS/RATIONALE:

LOSS OF REDUNDANCY FOR MONITORING OF HEATER STATUS. IF BOTH SENSORS ARE LOST, MISSION MAY BE TERMINATED EARLY.

DATE: 1/05/87 HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: APU FLIGHT: 3/2R MDAC ID: 416 ABORT: 3/3

ITEM: FUEL PUMP OUTLET TEMPERATURE SENSOR V46T0112A

(212,312)

FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) INSTRUMENTATION
- 3) FUEL PUMP OUTLET TEMPERATURE SENSOR

4)

5)

6)

7)

8) 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/2R	AOA:	3/3
DEORBIT:	3/3	ATO:	3/3
LANDING/SAFING:	3/3		•

REDUNDANCY SCREENS: A [1] B [P] C [P]

LOCATION: AFT COMPARTMENT PART NUMBER: MC201-0001-0001

CAUSES: MANUFACTURING DEFECT, PIECE-PART STRUCTURAL FAILURE, VIBRATION, MECHANICAL SHOCK, CONTAMINATION, HANDLING DAMAGE

EFFECTS/RATIONALE:

LOSS OF REDUNDANCY FOR MONITORING OF HEATER STATUS. IF OTHER SENSOR IS LOST (V46T0128A, 228, 328), MISSION MAY BE TERMINATED EARLY.

HIGHEST CRITICALITY HDW/FUNC 1/05/87 DATE: FLIGHT: 3/2R SUBSYSTEM: APU 3/3 ABORT: MDAC ID: 417 FUEL PUMP BYPASS LINE TEMPERATURE SENSOR V46T0128A ITEM: (228,328)FAILURE MODE: ERRONEOUS OUTPUT LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES BREAKDOWN HIERARCHY: 1) APU INSTRUMENTATION 2) FUEL PUMP BYPASS LINE TEMPERATURE SENSOR 3) 4) 5) 6) 7) 8) 9)

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	V=-1=			
FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC	
PRELAUNCH:	3/3	RTLS:	3/3	
LIFTOFF:	3/3	TAL:	3/3	
ONORBIT:	3/2R	AOA:	3/3	
DEORBIT:	3/3	ATO:	3/3	
LANDING/SAFING	3/3			

REDUNDANCY SCREENS: A [1] B [P] C [P]

LOCATION:

AFT COMPARTMENT

PART NUMBER:

CAUSES: MANUFACTURING DEFECT, PIECE-PART STRUCTURAL FAILURE, VIBRATION, MECHANICAL SHOCK, CONTAMINATION, HANDLING DAMAGE

EFFECTS/RATIONALE:

LOSS OF REDUNDANCY FOR MONITORING OF HEATER STATUS. IF OTHER SENSOR IS LOST (V46T0112A, 212, 312), MISSION MAY BE TERMINATED EARLY.

HIGHEST CRITICALITY HDW/FUNC DATE: 7/25/87

SUBSYSTEM: APU 3/3 FLIGHT: MDAC ID: 418 ABORT: 1/1

ITEM: CONTROLLER GG INJECTOR COOLING CONTROL

FAILURE MODE: PREMATURE START COMMAND

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- CONTROLLER 2)
- 3) GG INJECTOR COOLING CONTROL

4)

- 5)
- 6)
- 7) 8)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/3	AOA:	3/3
DEORBIT:	3/3	ATO:	1/1
LANDING/SAFING:	3/3		

REDUNDANCY SCREENS: A [NA] B [NA] C [NA]

LOCATION: AV BAY 4, 5, 6

PART NUMBER: MC201-0001

CAUSES: PIECE-PART FAILURE, SHORT

EFFECTS/RATIONALE:

PREMATURE START OF HOT APU MAY CAUSE DETONATION OF FUEL IN INJECTOR, WITH SUBSEQUENT FUEL LEAK AND FIRE HAZARD. THIS CIRCUIT IS NOT USED DURING NORMAL MISSION.

7/25/87 HIGHEST CRITICALITY HDW/FUNC DATE:

FLIGHT: 1/1 SUBSYSTEM: APU ABORT: 1/1 MDAC ID: 419

ITEM: CONTROLLER SECONDARY SPEED CONTROL

FAILURE MODE: PREMATURE OUTPUT - INADVERTENT APU RESTART

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) CONTROLLER
- 3) SPEED CONTROL
- SECONDARY SPEED CONTROL 4)

5)

6)

7)

8)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	1/1	TAL:	3/3
ONORBIT:	1/1	AOA:	3/3
DEORBIT:	3/3	ATO:	1/1
LANDING/SAFING:	1/1		

REDUNDANCY SCREENS: A [NA] B [NA] C [NA]

LOCATION: AV BAY 4, 5, 6 PART NUMBER: MC201-0001

CAUSES: PIECE-PART FAILURE, SHORT

EFFECTS/RATIONALE:

IF HOT APU RESTARTS INADVERTENTLY DUE TO SPURIOUS OUTPUT TO OPEN SECONDARY FUEL VALVE, RESULT COULD BE FUEL DETONATION IN THE INJECTOR, WITH SUBSEQUENT FUEL LEAK AND FIRE HAZARD.

HIGHEST CRITICALITY HDW/FUNC DATE: 8/04/87

FLIGHT: SUBSYSTEM: APU 3/2R MDAC ID: 420 ABORT: 3/2R

ITEM: LUBE OIL LINE HEATER SWITCH POWER FUSE

FAILURE MODE: FAIL OPEN

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) ELECTRICAL SYSTEM
- 3) LUBE OIL LINE HEATER CONTROL CIRCUIT
- 4) SWITCH POWER FUSE

5)

6)

7)

8) 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/2R	AOA:	3/3
DEORBIT:	3/3	ATO:	3/2R
LANDING/SAFING:	3/3	•	•

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION: PANEL A12

PART NUMBER: ME451-0018-0100

CAUSES: PIECE-PART STRUCTURAL FAILURE, MANUFACTURING DEFECT

EFFECTS/RATIONALE:

NO EFFECT FROM FIRST FAILURE, DUE TO SWITCH CONTACT REDUNDANCY. IF FUNCTION IS LOST, MISSION MAY HAVE TO BE CUT SHORT TO AVOID LOSS OF APUS DUE TO COLD LUBE OIL.

DATE: 8/05/87 HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: APU FLIGHT: 2/1R MDAC ID: 421 ABORT: 2/1R

ITEM: FUEL TANK VALVE CONTROL CIRCUIT BREAKER

FAILURE MODE: FAIL CLOSED

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) ELECTRICAL SYSTEM
- 3) FUEL TANK VALVE CONTROL CIRCUIT
- 4) CIRCUIT BREAKER

5)

6)

7)

8)

9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	2/1R	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	2/1R	AOA:	3/3
DEORBIT:	3/3	ATO:	2/1R
LANDING/SAFING:	2/1R		
•	-		

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION: PANEL R2

PART NUMBER: MC454-0026-2030

CAUSES: PIECE-PART STRUCTURAL FAILURE, MANUFACTURING DEFECT

EFFECTS/RATIONALE:

IF SWITCH ALSO FAILS CLOSED, VALVE IS POWERED CONTINUOUSLY, FUEL CAN OVERHEAT AND DETONATE, LEADING TO FUEL LEAK AND POSSIBLE FIRE.

DATE: 8/05/87 HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: APU FLIGHT: 3/1R MDAC ID: 422 ABORT: 3/1R

ITEM: CONTROLLER POWER CIRCUIT POWER INPUT DIODE

FAILURE MODE: INTERNAL SHORT

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) ELECTRICAL SYSTEM
- 3) CONTROLLER POWER CIRCUIT
- 4) POWER INPUT DIODE
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

HDW/FUNC	ABORT	HDW/FUNC
3/3	RTLS:	3/1R
3/1R	TAL:	3/1R
3/1R	AOA:	3/1R
3/1R	ATO:	3/1R
3/1R		-
	3/1R 3/1R 3/1R	3/3 RTLS: 3/1R TAL: 3/1R AOA: 3/1R ATO:

REDUNDANCY SCREENS: A [3] B [F] C [P]

LOCATION: AV BAY 4, 5, 6
PART NUMBER: JANTX1N1188R

CAUSES: CONTAMINATION, MANUFACTURING DEFECT

EFFECTS/RATIONALE:

FAILURE OF BOTH DIODES TO ONE APU CONTROLLER TIES TWO MAIN BUSES TOGETHER. A SHORT ON ONE MAIN BUS CAN DROP VOLTAGE ON BOTH MAINS, LEADING TO LOSS OF ONE APU AND OTHER EFFECTS.

DATE: 8/05/87 HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: APU FLIGHT: 3/1R MDAC ID: 423 ABORT: 3/1R

ITEM: FUEL TANK VALVE SWITCH OUTPUT DIODE

FAILURE MODE: INTERNAL SHORT

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) ELECTRICAL SYSTEM
- 3) FUEL TANK VALVE CONTROL CIRCUIT
- 4) SWITCH OUTPUT DIODE
- 5)
- 6)
- 7) 8)
- 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/1R	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/1R	AOA:	3/3
DEORBIT:	3/3	ATO:	3/1R
LANDING/SAFING:	3/3		

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION: AFT LCA 1, 2, 3
PART NUMBER: JANTXV1N5551

CAUSES: CONTAMINATION, MANUFACTURING DEFECT

EFFECTS/RATIONALE:

THIS FAILURE PLUS THREE OTHER FAILURES (SWITCH CONTACT SHORTS, DIODE SHORTS, SWITCH SHORTS POLE-TO-POLE) CAN CAUSE INADVERTENT ENERGIZING OF ISOLATION VALVE. SOLENOID CAN OVERHEAT ON-ORBIT, LEADING TO FUEL DECOMPOSITION AND FUEL LINE RUPTURE.

DATE: 8/05/87 HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: APU FLIGHT: 3/1R MDAC ID: 424 ABORT: 3/1R

ITEM: FUEL TANK VALVE GROUND MDM COMMAND DIODE

FAILURE MODE: INTERNAL SHORT

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) ELECTRICAL SYSTEM
- 3) FUEL TANK VALVE CONTROL CIRCUIT
- 4) GROUND MDM COMMAND DIODE
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/1R	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/1R	AOA:	3/3
DEORBIT:	3/3	ATO:	3/1R
LANDING/SAFING	: 3/3		•

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION: AFT LCA 1, 2, 3
PART NUMBER: JANTXV1N5551

CAUSES: CONTAMINATION, MANUFACTURING DEFECT

EFFECTS/RATIONALE:

THIS FAILURE PLUS TWO OTHERS (2 SWITCH CONTACTS FAIL CLOSED, CIRCUIT BREAKER FAIL CLOSED) CAN CAUSE INADVERTENT ENERGIZING OF ISOLATION VALVE. SOLENOID CAN OVERHEAT ON-ORBIT, LEADING TO FUEL DECOMPOSITION AND FUEL LINE RUPTURE.

DATE: 8/05/87 HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: APU FLIGHT: 3/1R MDAC ID: 425 ABORT: 3/1R

ITEM: FUEL TANK VALVE SWITCH OUTPUT RESISTOR

FAILURE MODE: FAIL OPEN

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) ELECTRICAL SYSTEM
- 3) FUEL TANK VALVE CONTROL CIRCUIT
- 4) SWITCH OUTPUT RESISTOR
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

HDW/FUNC	ABORT	HDW/FUNC
3/3	RTLS:	3/1R
3/1R	TAL:	3/1R
3/1R	AOA:	3/1R
3/1R	ATO:	3/1R
3/1R		
	3/3 3/1R 3/1R 3/1R	3/3 RTLS: 3/1R TAL: 3/1R AOA: 3/1R ATO:

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION: AFT LCA 1, 2, 3
PART NUMBER: RLR42C120GR

CAUSES: MECHANICAL SHOCK, MANUFACTURING DEFECT

EFFECTS/RATIONALE:

FOUR RESISTORS MUST FAIL TO FAIL BOTH FUEL TANK VALVES AND LOSE ONE APU. LOSS OF VEHICLE REQUIRES ANOTHER APU FAILURE.

DATE: 8/05/87 HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: APU FLIGHT: 3/1R MDAC ID: 426 ABORT: 3/1R

ITEM: FUEL TANK VALVE AUTO SHUTDOWN DIODE

FAILURE MODE: FAIL OPEN

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) ELECTRICAL SYSTEM
- 3) FUEL TANK VALVE CONTROL CIRCUIT
- 4) AUTO SHUTDOWN DIODE
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/1R	RTLS:	3/1R
LIFTOFF:	3/1R	TAL:	3/1R
ONORBIT:	3/1R	AOA:	3/1R
DEORBIT:	3/1R	ATO:	3/1R
LANDING/SAFING	: 3/1R		•

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION: AFT LCA 1, 2, 3
PART NUMBER: JANXV1N5551

CAUSES: MECHANICAL SHOCK, MANUFACTURING DEFECT

EFFECTS/RATIONALE:

IN ORDER TO PREVENT APU AUTO SHUTDOWN, TWO DIODE FAILURES PLUS A SECONDARY FUEL VALVE FAILURE ARE REQUIRED. OVERSPEEDING APU CAN CAUSE SHRAPNEL AND FIRE HAZARD.

HIGHEST CRITICALITY HDW/FUNC DATE: 8/05/87

SUBSYSTEM: APU FLIGHT: 3/1R ABORT: 3/1R MDAC ID: 427

FUEL TANK VALVE AUTO SHUTDOWN INHIBIT DRIVER POWER ITEM:

FUSE

FAILURE MODE: FAIL OPEN

SUBSYS LEAD: J. BARNES LEAD ANALYST: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- ELECTRICAL SYSTEM 2)
- FUEL TANK VALVE CONTROL CIRCUIT
- FUEL TANK VALVE AUTO SHUTDOWN INHIBIT DRIVER POWER FUSE 4)

5) 6)

7)

8)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/1R	RTLS:	3/1R
LIFTOFF:	3/1R	TAL:	3/1R
ONORBIT:	3/1R	AOA:	3/1R
DEORBIT:	3/1R	ATO:	3/1R
LANDING/SAFING	3/1R		

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION: AFT PCA 1, 2, 3 PART NUMBER: ME451-0018-0300

CAUSES: MECHANICAL SHOCK, MANUFACTURING DEFECT

EFFECTS/RATIONALE:

LOSS OF THIS FUSE ELIMINATES AUTO SHUTDOWN CAPABILITY FOR FUEL TANK VALVES. APU OVERSPEED REQUIRES FAILURE OF SECONDARY FUEL VALVE PLUS FAILURE OF PRIMARY FUEL VALVE. APU OVERSPEED PRODUCES SHRAPNEL AND FIRE HAZARD.

DATE: 8/06/87 HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: APU FLIGHT: 3/1R MDAC ID: 428 ABORT: 2/1R

ITEM: CONTROLLER POWER CIRCUIT SWITCH SCAN DIODE

FAILURE MODE: INTERNAL SHORT

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) ELECTRICAL SYSTEM
- 3) CONTROLLER POWER CIRCUIT
- 4) SWITCH SCAN DIODE
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	2/1R
LIFTOFF:	3/1R	TAL:	2/1R
ONORBIT:	3/1R	AOA:	2/1R
DEORBIT:	3/1R	ATO:	2/1R
LANDING/SAFING:	3/1R		•

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION: AFT PCA 4, 5, 6
PART NUMBER: JANTXV1N4246

CAUSES: CONTAMINATION, MANUFACTURING DEFECT

EFFECTS/RATIONALE:

FAILURE OF TWO DIODES REMOVES BUS ISOLATION FROM TWO CONTROL BUSES; ANY VOLTAGE DIFFERENCE CAN BLOW ONE FUSE AND LOSE ONE CONTROLLER POWER SOURCE. ONE SUBSEQUENT FAILURE CAN LOSE ONE APU. LOSS OF ONE MORE APU IS LOSS OF VEHICLE. ABORT: LOSS OF ONE APU CAN CAUSE LOSS OF VEHICLE.

HIGHEST CRITICALITY HDW/FUNC 8/06/87 DATE:

3/1R FLIGHT: SUBSYSTEM: APU ABORT: 2/1R MDAC ID: 429

APU CONTROL CIRCUIT SWITCH SCAN DIODE ITEM:

FAILURE MODE: INTERNAL SHORT

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) ELECTRICAL SYSTEM
- 3) APU CONTROL CIRCUIT
- SWITCH SCAN DIODE 4)
- 5)
- 6)
- 7)
- 8)

9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	2/1R
LIFTOFF:	3/1R	TAL:	2/1R
ONORBIT:	3/1R	AOA:	2/1R
DEORBIT:	3/1R	ATO:	2/1R
LANDING/SAFING:	3/1R		

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION: AFT LCA 1, 2, 3 PART NUMBER: JANTXV1N551

CAUSES: CONTAMINATION, MANUFACTURING DEFECT

EFFECTS/RATIONALE:

FIRST FAILURE TIES ONE CONTROL BUS TO ANOTHER; VOLTAGE DIFFERENCE CAN BLOW A SWITCH POWER FUSE. SUBSEQUENT FAILURE OF SECOND FUSE CAUSES LOSS OF ONE APU. LOSS OF ANOTHER APU IS LOSS OF VEHICLE. ABORT: LOSS OF ONE APU CAN CAUSE LOSS OF VEHICLE.

HIGHEST CRITICALITY HDW/FUNC DATE: 8/06/87

FLIGHT: 3/3 SUBSYSTEM: APU 1/1 ABORT: MDAC ID: 430

APU CONTROL CIRCUIT CIRC PUMP INHIBIT DIODE ITEM:

FAILURE MODE: INTERNAL SHORT

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) ELECTRICAL SYSTEM
- 3) APU CONTROL CIRCUIT
- CIRC PUMP INHIBIT DIODE 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/3	AQA:	3/3
DEORBIT:	3/3	ATO:	1/1
LANDING/SAFING:	3/3	•	

REDUNDANCY SCREENS: A [NA] B [NA] C [NA]

AFT LCA 1, 2, 3 LOCATION: PART NUMBER: JANTXV1N5551

CAUSES: CONTAMINATION, MANUFACTURING DEFECT

EFFECTS/RATIONALE:

SHORTS OVERRIDE START COMMAND TO NORMAL START COMMAND; APU HOT START CAN LEAD TO APU PREMATURE START, WITH POTENTIAL FOR DETONATION, FUEL LEAK, AND FIRE HAZARD. CRITICALITY IS 1/1 FOR ABORT.

HIGHEST CRITICALITY HDW/FUNC DATE: 8/05/87

SUBSYSTEM: APU FLIGHT: 3/2R 3/3 MDAC ID: 431 ABORT:

ITEM: LUBE OIL LINE HEATER SWITCH POWER DIODE - CR2

FAILURE MODE: FAIL OPEN

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- APU 1)
- 2) ELECTRICAL SYSTEM
- 3) LUBE OIL LINE HEATER CONTROL CIRCUIT
- SWITCH POWER DIODE CR2 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/2R ·	AOA:	3/3
DEORBIT:	3/3	ATO:	3/3
LANDING/SAFING:	3/3		•

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION: PANEL A12 PART NUMBER: JANTXV1N4626

CAUSES: MECHANICAL SHOCK, MANUFACTURING DEFECT

EFFECTS/RATIONALE:

DIODE FAILURE PLUS ANOTHER DIODE FAILURE CAN FAIL BOTH LUBE OIL HEATERS ON ONE APU. THIS SITUATION REPRESENTS LOSS OF MISSION.

DATE: 1/11/88 HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: APU FLIGHT: 3/1R MDAC ID: 432 ABORT: 3/1R

ITEM: LUBE OIL LINE HEATER SWITCH SCAN DIODE

FAILURE MODE: INTERNAL SHORT

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) ELECTRICAL SYSTEM
- 3) LUBE OIL LINE HEATER CONTROL CIRCUIT
- 4) SWITCH SCAN DIODE
- 5)
- 6) .
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/1R	AOA:	3/3
DEORBIT:	3/3	ATO:	3/1R
LANDING/SAFING:	3/3		·

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION: AFT LCA 1, 2, 3
PART NUMBER: JANTXV1N5551

CAUSES: CONTAMINATION, MANUFACTURING DEFECT

EFFECTS/RATIONALE:

THIS FAILURE PLUS THREE OTHERS (SWITCH FAIL CLOSED, THERMOSTAT FAIL CLOSED, LOSS OF ANOTHER APU) IS LOSS OF CREW/VEHICLE. OVERHEATING OF LUBE OIL DUE TO HEATER STUCK ON CAN CAUSE OIL SOLIDIFICATION, LOSS OF APU.

HIGHEST CRITICALITY HDW/FUNC DATE: 8/06/87

3/1R FLIGHT: SUBSYSTEM: APU 3/1R ABORT: MDAC ID: 433

LUBE OIL LINE HEATER GSE DRIVER DIODE ITEM:

FAILURE MODE: INTERNAL SHORT

SUBSYS LEAD: J. BARNES LEAD ANALYST: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- ELECTRICAL SYSTEM 2)
- LUBE OIL LINE HEATER CONTROL CIRCUIT
- 4) GSE DRIVER DIODE
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/1R	AOA:	3/3
DEORBIT:	3/3	ATO:	3/1R
LANDING/SAFING	•		•

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION: AFT LCA 1, 2, 3 PART NUMBER: JANTXV1N5551

CAUSES: CONTAMINATION, MANUFACTURING DEFECT

EFFECTS/RATIONALE:

FAILURE OF 2 DIODES ALLOWS ONE SWITCH CONTACT TO ACTIVATE HEATER. IF SWITCH CONTACT FAILS ON, HEATER IS STUCK ON. APU MAY BE LOST.

DATE: 1/11/88 HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: APU FLIGHT: 3/1R MDAC ID: 434 ABORT: 3/1R

ITEM: TANK/FUEL LINE HEATER SWITCH SCAN DIODE

FAILURE MODE: INTERNAL SHORT

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) ELECTRICAL SYSTEM
- 3) FUEL/H2O HEATER CONTROL CIRCUIT
- 4) TANK/FUEL LINE HEATER SWITCH SCAN DIODE

5)

6)

7)

8)

9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/1R	AOA:	3/3
DEORBIT:	3/3	ATO:	3/1R
TANDING/SAFING	• 3/3		,

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION: AFT LCA 1, 2, 3
PART NUMBER: JANTXV1N5551

CAUSES: CONTAMINATION, MANUFACTURING DEFECT

EFFECTS/RATIONALE:

THIS FAILURE PLUS TWO OTHERS (SWITCH FAIL CLOSED, THERMOSTAT FAIL CLOSED) CAN LEAD TO FUEL DECOMPOSITION AND LINE RUPTURE - OVERHEAT DUE TO HEATER STUCK ON.

DATE: 8/06/87 HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: APU FLIGHT: 3/1R MDAC ID: 435 ABORT: 3/1R

ITEM: TANK/FUEL LINE HEATER GSE DRIVER DIODE

FAILURE MODE: INTERNAL SHORT

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) ELECTRICAL SYSTEM
- FUEL/H2O LINE HEATER CONTROL CIRCUIT
- 4) TANK/FUEL LINE HEATER GSE DRIVER DIODE

5)

6)

7)

8)

9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/1R	AOA:	3/3
DEORBIT:	3/3	ATO:	3/1R
LANDING/SAFING:	3/3		' .

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION: AFT LCA 1, 2, 3 PART NUMBER: JANTXV1N5551

CAUSES: CONTAMINATION, MANUFACTURING DEFECT

EFFECTS/RATIONALE:

TWO DIODE FAILURES ALLOW VOLTAGE DIFFERENCE BETWEEN CONTROL BUSES TO BLOW ONE SWITCH POWER FUSE, KILLING ONE SET OF HEATERS. SAME FAILURE MODE CAN KILL SECOND HEATER SET, ALLOWING FUEL LINES TO FREEZE, WITH POSSIBLE FUEL LEAK AND FIRE.

DATE: 8/06/87 HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: APU 3/2R FLIGHT: MDAC ID: 436 ABORT: 3/2R

GAS GEN/FUEL PUMP HEATER SWITCH DIODE - CR1, CR2, ITEM:

CR3, CR4

FAILURE MODE: FAIL OPEN

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) ELECTRICAL SYSTEM
- 3) GG/FUEL PUMP HEATER CONTROL CIRCUIT
- 4) SWITCH DIODE
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/2R	AOA:	3/3
DEORBIT:	3/3	ATO:	3/2R
LANDING/SAFING:	3/3		

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION: PANEL A12 PART NUMBER: JANTXV1N4246

CAUSES: MECHANICAL SHOCK, MANUFACTURING DEFECT

EFFECTS/RATIONALE:

THIS FAILURE PLUS TWO OTHERS (DIODE FAIL OPEN, REDUNDANT HEATERS FAIL) CAUSES LOSS OF HEATERS FOR ONE APU. MISSION MUST BE

TERMINATED EARLY.

8/07/87 DATE:

HIGHEST CRITICALITY HDW/FUNC

FLIGHT: 3/1R SUBSYSTEM: APU 3/1R MDAC ID: 437 ABORT:

GAS GEN/FUEL PUMP HEATER SWITCH SCAN DIODE ITEM:

FAILURE MODE: INTERNAL SHORT

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) ELECTRICAL SYSTEM
- 3) GG/FUEL PUMP HEATER CONTROL CIRCUIT
- SWITCH SCAN DIODE 4)

5)

6)

7)

8)

9)

CRITICALITIES

FLIGHT PHASE PRELAUNCH:	HDW/FUNC 3/1R	ABORT RTLS:	HDW/FUNC 3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/1R	AOA:	3/3
DEORBIT: LANDING/SAFING:	3/3 3/3	ATO:	3/1R

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION: AFT LCA 1, 2, 3

PART NUMBER: JANTXV1N5551

CAUSES: CONTAMINATION, MANUFACTURING DEFECT

EFFECTS/RATIONALE:

TWO DIODE FAILURES CONNECT ALL 3 FUEL PUMP/VALVE HEATERS TO ONE SWITCH CONTACT. FAILURE OF SWITCH CONTACT (SHORTED) PLUS THERMOSTAT FAIL ON CAUSES HEATER TO BE STUCK ON. FUEL CAN DETONATE, LEADING TO LINE RUPTURE AND FIRE HAZARD.

DATE: 8/07/87 HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: APU FLIGHT: 3/1R MDAC ID: 438 ABORT: 3/1R

ITEM: GAS GEN/FUEL PUMP HEATER GROUND COMMAND DRIVER

DIODE

FAILURE MODE: INTERNAL SHORT

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) ELECTRICAL SYSTEM
- 3) GG/FUEL PUMP HEATER CONTROL CIRCUIT
- 4) GROUND COMMAND DRIVER DIODE
- 5)
- 6)
- 7)
- 8)

9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/1R	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/1R	AOA:	3/3
DEORBIT:	3/3	ATO:	3/1R
LANDING/SAFING:	3/3		

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION: AFT LCA 1, 2, 3
PART NUMBER: JANTXV1N5551

CAUSES: CONTAMINATION, MANUFACTURING DEFECT

EFFECTS/RATIONALE:

TWO DIODE FAILURES TIE ALL 3 HEATER DRIVERS TO ONE SWITCH CONTACT. SWITCH CONTACT FAILURE (SHORT) PLUS THERMOSTAT FAILED CLOSED RESULTS IN HEATER STUCK ON. RESULT CAN BE FUEL DETONATION, WITH FUEL LEAK AND FIRE HAZARD.

DATE: 8/06/87 HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: APU FLIGHT: 3/1R MDAC ID: 439 ABORT: 3/1R

ITEM: GAS GEN HEATER DRIVER

FAILURE MODE: FAIL ON

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) ELECTRICAL SYSTEM
- 3) GG/FUEL PUMP HEATER CONTROL CIRCUIT
- 4) GG HEATER DRIVER

5)

6)

7)

8) 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/1R	AOA:	3/3
DEORBIT:	3/3	ATO:	3/1R
LANDING/SAFING	3/3		•

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION: AFT LCA 1, 2, 3
PART NUMBER: MC477-0263-0002

CAUSES: CONTAMINATION, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:

TWO DRIVERS FAILED ON WILL FAIL ONE HEATER ON. THAT APU WILL NOT BE SAFELY STARTABLE, IF INJECTOR COOLING IS LOST. LOSS OF ONE MORE APU IS LOSS OF CREW/VEHICLE.

DATE: 8/06/87 HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: APU FLIGHT: 3/1R MDAC ID: 440 ABORT: 3/1R

ITEM: FUEL PUMP/LINE HEATER DRIVER - TYPE 3

FAILURE MODE: FAIL ON

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) ELECTRICAL SYSTEM
- 3) GG/FUEL PUMP HEATER CONTROL CIRCUIT
- 4) FUEL PUMP/LINE HEATER DRIVER TYPE 3
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/1R	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/1R	AOA:	3/3
DEORBIT:	3/3	ATO:	3/1R
LANDING/SAFING:	3/1R	•	•

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION: AFT LCA 1, 2, 3
PART NUMBER: MC477-0263-0002

CAUSES: CONTAMINATION, MANUFACTURING DEFECT

EFFECTS/RATIONALE:

THREE DRIVER FAILURES CAUSE HEATER TO FAIL ON. RESULT CAN BE FUEL DETONATION, LEADING TO FUEL LEAK AND FIRE HAZARD DURING ENTRY.

DATE:

1/28/88

HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: APU MDAC ID:

FLIGHT:

3/2R

441

ABORT:

3/2R

ITEM:

LUBE OIL LINE HEATER SWITCH POWER DIODE-CR2

FAILURE MODE: INTERNAL SHORT

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- APU
- 2) ELECTRICAL SYSTEM
- LUBE OIL LINE HEATER CONTROL CIRCUIT
- 4) SWITCH POWER DIODE-CR2

5)

6)

7)

8)

9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/2R	AOA:	3/3
DEORBIT:	3/3	ATO:	3/2R
LANDING/SAFING	3/3		- /

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION: PANEL A12

PART NUMBER: JANTXV1N4626

CAUSES: CONTAMINATION, MANUFACTURING DEFECT

EFFECTS/RATIONALE:

DIODE SHORT TIES TWO CONTROL BUSES TOGETHER. CONTROL BUS SHORT CAN BLOW FUSE, LEADING TO LOSS OF ONE LUBE OIL LINE HEATER. LOSS OF NEXT HEATER IS LOSS OF MISSION.

1/28/88 HIGHEST CRITICALITY HDW/FUNC DATE:

SUBSYSTEM: APU FLIGHT: 3/2R

MDAC ID: 442 ABORT:

ITEM: LUBE OIL LINE HEATER SWITCH POWER RESISTOR

FAILURE MODE: INTERNAL SHORT

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) ELECTRICAL SYSTEM
- 3) LUBE OIL LINE HEATER CONTROL CIRCUIT
- 4) SWITCH POWER RESISTOR
- 5)
- 6)
- 7)
- 8)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/2R	AOA:	3/3
DEORBIT:	3/3	ATO:	3/2R
LANDING/SAFING:	3/3		•

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION: PANEL A12 PART NUMBER: RER65F2150M

CAUSES: CONTAMINATION, MANUFACTURING DEFECT

EFFECTS/RATIONALE:

RESISTOR SHORT PLUS DIODE SHORT IN SAME POWER CIRCUIT PLUS SHORTED CONTROL BUS KILLS ONE LUBE OIL LINE HEATER. LOSS OF REDUNDANT HEATER IS LOSS OF MISSION.

DATE: 1/28/88 HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: APU FLIGHT: 3/2R MDAC ID: 443 ABORT: 3/2R

ITEM: GAS GENERATOR/FUEL PUMP HEATER SWITCH POWER

RESISTOR

FAILURE MODE: INTERNAL SHORT

LEAD ANALYST: J. BARNES SUBSYS LEAD: J. BARNES

BREAKDOWN HIERARCHY:

- 1) APU
- 2) ELECTRICAL SYSTEM
- 3) GG/FUEL PUMP HEATER CONTROL CIRCUIT
- 4) SWITCH POWER RESISTOR

5)

6)

7) 8)

9)

CRITICALITIES

	O2/2 2 4 O2/		
FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/2R	AOA:	3/3
DEORBIT:	3/3	ATO:	3/2R
LANDING/SAFING:	3/3		

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION: PANEL A12
PART NUMBER: RWR80N6190FR

CAUSES: CONTAMINATION, MANUFACTURING DEFECT

EFFECTS/RATIONALE:

RESISTOR SHORT PLUS DIODE SHORT PLUS CONTROL BUS VOLTAGE DIFFERENCE CAN DAMAGE WIRING, CAUSING LOSS OF GG/FUEL PUMP HEATER. IF REDUNDANT HEATERS ARE LOST, MISSION MUST BE TERMINATED.

APPENDIX F

NASA FMEA TO IOA WORKSHEET CROSS REFERENCE/RECOMMENDATIONS

This section provides a cross reference between the NASA FMEA and corresponding IOA analysis worksheet(s) included in Appendix E. The Appendix F identifies: NASA FMEA Number, IOA Assessment Number, NASA criticality and redundancy screen data, and IOA recommendations.

Appendix F Resolution/Issue/Rationale Codes

Code Definition

- 1 IOA recommends a higher criticality.
- 2 IOA recommends an additional failure mode.
- 3 IOA recommends a lower criticality.
- 4 IOA recommends a change to a redundancy screen.
- 5 IOA concurs with NASA analysis.
- 6 IOA generated a non-credible failure mode.

APPENDIX F

MASA FMEA TO 10A WORKSHEET CROSS REFERENCE / RECOMMENDATIONS

MASA	IDENT	IFIERS		N	AS	A			 !!			IOA RECOM	1EN	DATIONS \$		·
04-2-0108-2													!		ISSUE	
04-2-0112-2	0 4- 2-010 4- 2	: APU-414X	11	3/2R	;	P	ρ	P	-11	/	-;					-
04-2-0115-1	04-2-0108-2	APU-415X	!!	3/2R	į	P	p	P	11	1	1		5			1
04-2-0115-2	04-2-0112-2	1 APU-416X	; ;	3/2R	1	P	P	P	3 [1	;		5		1	ì
04-2-0122-1	04-2-0115-1	APU-324	! !	3/3	ì	NA	NA	NA	1 1	1	į		5		i	i
04-2-0151-1	04-2-0115-2	: APU-325	; ; ; ;	3/3	!	NA	NA	NA	i i	1	į		5		! :	į
04-2-0183-1	04-2-0122-1	APU-375	11	3/3	i	ΝA	NA	NA	1 1	1	i		5		1	:
04-2-0183-2	04-2-0151-1	: APU-374	1 1	3/1R	;	P	Ρ	Р	1 1	. 1	j		5		i,	;
04-2-0183-1	04-2-0183-1	! APU-412X	1 1	3/3	ţ	NA	NA	NΑ	1 1	1	:		5		i	;
04-2-0186-2	04-2-0183-2	: APU-376	1 1. 1 1.	3/1R	į	Ρ	P	Ρ	! ;	1	i		5	i	i	i
04-2-CFD01-2	04-2-0186-1	: APU-413X	1 1 1 i	3/3	į	AK	NA	MA	! !	1	i		5		į	;
04-2-CFD02-3	04-2-0186-2	: APU-377	! i	3/1R	;	P	Ρ	۴	1 1	1	!		5		! i	!
04-2-CFH01-1	04-2-CFD01-2			1/1							1				:	i
04-2-CFH02-1	0 4- 2- CFD 02-3	: APU-258	1 :	3/3	i	NA	NA	MA	11	1	i		5	i	! i	i
04-2-CBC01-1	0 4- 2-CFH01-1	: APU-252	1 1	3/3	-	-	•	•			;		_		i	i
04-2-CHR01-1	04-2-CFH02-1	: APU-239	!!	1/1	i	NA	NA	NΑ	; ;	1	1				? •	1
APU-405X)4-2-C6C01-1	1 APU-231	1 1	1/1	į	NA	NA	NA	1 1	1	;		_		i	i
04-2-CHR01-2	04-2-CHR01-1	: APU-404X	 	3/3	i	NA	NA	NA	1 1	1	!		: 3		;	i
APU-26B		: APU-405X	1 !	3/3	1	NA	NΑ	NA	: ;	1	. 1		5		1	!
04-2-CHR03-1	04-2-CHR01-2	: APU-240	! !	3/3	;	NA	NA	NA	1 1	/	i		5		;	1
		: APU-268	!!	3/3	!	MA	NA	NA	11	1	;				į	i
04-2-CL01-1	04-2-CHR03-1	: APU-2 4 3	1 1	3/3	į	NA	NA	NA	; ;	1	;		5		:	i
04-2-CL03-1		: APU-271	11	3/3	;	NA	NA	ΝA	11	1	i		5		1	i
APU-237	04-2-CL01-1	: APU-184	1 }	2/1R	i	٩	٩	P	1 1	1	1		: 5		:	i
04-2-CL03-2	04-2-CL03-1	: APU-233	: :	3/3	i	NA	NA	NA	1 1	1	!				i	i
APU-23B		APU-237	1 1	3/3	ï	NΑ	NA	NA	1 1	1	ì	•	5		!	1
04-2-CL10-1)4-2-CL03-2			3/3						/	i		5		į	1
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)4-2-CL10-1				į	P	P	P			i		-		ŧ	:
				3/3	į	۴	P	Ρ	; 1	1	;				}	1
04-2-CL1A-11		: APU-256	11	3/3	į	NA	NA	NA	1 !	F	i				1 i	i
04-2-CLV06-1		: APU-260	1 1	3/3	-		NA	NA	1 1	1	-					i
APU-267							•			7	ŧ				<i>;</i> :	i
04-2-CLV06-3)4-2-CLV06-1										1				!	i
04-2-CLV13-1											ì				1	ŧ
APU-266											1				! !	i
1 04-2-CLV13-2	04-2-CLV13-1										ì				! i	į
1 1 APU-225 11 3/3 NA NA NA 11 / 1 1.5 1											1				1	ì
	0 4- 2-CLV13-2									-	i				!	1
! APU-227 !! 3/3 ! NA NA NA !! / ! ! 5 !											;				1	İ
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: APU-228 3/3 NA NA NA	•										i				!	!
1 04-2-CLV15-1 APU-250 3/3 NA NA NA / 5	04-2-CLV15-1										!				l	i
APU-252											i				i	!
: 04-2-CLV15-2 APU-251 3/3 NA NA NA / 5											i		_) i	1
04-2-CNA01-1	04-2-CNA01-1			3/3	1	NA	NA	NA			;		5			į
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04-2-CONTL1-12		1 2/1R		i /	1 1	-	i
04-2-CONTL2-11		1 2/1R		1 7	!		1
04-2-CONTL2-12			: NA NA NA :	, ,		-	1
04-2-CONTL2-2		: 3/1R		! /			!
04-2-CDNTL3-1	· ···	3/1R		1 /	1		i !
04-2-CONTL3-2	= •••		I NA NA NA I				1
04-2-CCNTL3-3			NA NA NA		! !		1
04-2-CONTL3-4		1 3/1R		1 /		5	1
04-2-CONTL5-1		1 2/1R		1 /	•	5	
04-2-CDNTL5-12		1 2/18		1 /	•	5 5	1
04-2-CDNTL6-1		1 3/1R		1 /	i 1	5 5	i
04-2-CONTL7-1			I F F F I I NA NA NA I	•	i i	=	1
04-2-CONTL7-12			: NA NA NA :		! ! !	-	i
04-2-CBV01-1					; !		i
04-2-CRV01-1 04-2-CRV01-2			! NA NA NA !			-	i
04-2-CS01-1			: NA NA NA :		! !	•	i
V4-7-0301-1			! NA NA NA !			-	i
AA O PPA+ O			i na na na i		•	5	i
04-2-CS01-2	APU-241		: NA NA NA :			5	i
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04-2-CS03-1			NA NA NA :			5	•
04-2-C503-2			NA NA NA I			5 -	i
04-2-CS10-1			NA NA NA :		•	5	ì
04-2-CS10-2			NA NA NA I			5	:
04-2-CTK01-1			NA NA NA I		•	5	i
04-2-CTK01-2			NA NA NA I		•	5	ì
04-2-CTK06-1			NA NA NA I		!	=	;
04-2-CTK06-2			NA NA NA I			5.	:
04-2-FBRV01-1	APU-216			1 /	<u> </u>	5	i
04-2-FL11-11	: APU-174	1 2/1R	FPP 1	1 /	!	5	1
04-2-FL11-12			NA NA NA 1	! /		5	!
04-2-FL12-11			F P P I		1	•	} ‡
)4-2-FL12-12	: APU-137 :					5	i
04-2-FL13-11			PPP!		! ;	5)
)4-2-FL13-12			PPP	1 /		5	i
04-2-6611-11			PPP;		; !		} !
)4-2-GG11-2	: APU-101 :	1/1 1	NA NA NA ([/	1	5	i. I
)4-2-6T11-11			PPPI	! /	! !	5	i i
	APU-203	1 2/1R 1			1 1	5	! 1
	APU-215	1 2/1R 1	PPP;	1 /	;	5	1 1
	APU-220	1 2/1R 1	PPP!	[/ :		5	!
	: APU-222	1 2/1R 1	PPPI	1 /	;	5) i
	: APU-278	1 2/1R 1	PPP:	1 /	1	5	!
)4-2-6T11-2		1 2/1R 1		/		5	ŀ
	: APU-279 :	1 2/1R 1	P P P !	/		5	ŀ
04-2-HR10-2		3/2R (1 /	[5	•
)4-2-HR11-11		3/2R I		1 /		5) :
)4-2-HR111-1		3/1R :					i i
04-2-HR116-11		3/2R					1
)4-2-HR13-11			NA NA NA :				
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! NASA ! FMEA NUMBER	IDA ASSESSMENT NUMBER			:: CAIT :: HW/F	: SCREENS ! A 3 C	(SEE LEGEND CODE)	: 155UE
: 04-2-HR13-11	: APU-108	: ,	NA NA NA		;	[5	(
1			! HA NA NA	11 /	1	: 5	!
04-2-HR14-11	: APU-163	3/2R	1 P P P	11 /	1	1 5	i i
1 04-2-HR17-11	APU-171	11 3/2R	: P P P	H /	1	: 5	ì
1 94-2-HR18-11	(APU-210	11 3/2R	1222	11 /	<i>!</i>	: 5	1
1 04-2-L1-11	: APU-151	1/1	. NA NA NA	11 /	i	: 5	1
!	: APU-152	1/1	L NA NA NA	11 /	:	: 5	1
i	APU-175	1/1	PPP	11 /	1	5	!
1	APU-177	11 1/1	PPP	H /	1	1 5	:
04-2-L1A-11	: APU-157	1/1	I NA NA NA	11 /	i	1.5	!
: 04-2-L2-11	APU-197	1 2/1R	PPP	H = I	i	1 5	1
1 04-2-L2A-11	1 APU-198	1 2/1R	PPP	H /	i	1 5	!
: 04-2-L3-11	APU-119	11 2/1R	PPP	11 /	1	1.5	1
1 04-2-L4-11	: APU-104	1/1	! NA NA NA	H /	i	5	<u> </u>
1	: APU-105	1/1	! NA NA NA	H /	1	: 5	!
1 04-2-LV11-10		1/1		H /	!	5 5	!
1		1/1		11 /	!	1 5	į
: 04-2-LV11-11		11 3/1R		11 /	:	5	1
i			CF F F	H /		1.5	!
: 04-2-LV11-12		. 1 9/ 11		11 /	1	. 5	
1 04-2-LV11-14		3/1R		H /	1	5. 6	í
1 04-2-LV12-1 .		Z/1R		H /		1 5	
	· · · · · · · · · · · · · · · · · · ·	1 2/1R		11 /	!	1 5	
1 04-2-LV12-2				11 /	1	1 5	
1 05 5 11147 4		11 2/1R		H /	i	1.5	1
1 04-2-LV13-1				11 /	1	15	i
i			! NA NA NA		i	: 5	i
1 04-2-LV13-2		1/1 2/1R		H, / . H /	1	CJ	i 1
, 04-7-FA12-5		11 2/1R		11 /	1	: a 1 5	1
04-2-LV14-1		1 3/1R		11 /	į.	. 5	! !
: 04-2-LV14-2		1 3/1K		11 /	1	: 5	į
i 04-7-6414-7				:. <i>;</i> []	!	; 5	
: 04-2-MD11-11			: NA NA NA		· •	; 5	!
1 04-2-MD11-13				1 1	!	. 5 ! 5	!
04-2-MD12-11			NA NA NA			: 5	
: 04-2-MD12-13				 [] /		: 5	
1 04-2-MD13-11	· · · · · · · · · · · · · · · · · · ·		I NA NA NA			1.5	1
1 04-2-MD13-13			FFP			1 5	†
1 04-2-MD14-1			I NA NA NA	11 /	1	1 5	1
!			NA NA NA		;	1 5	!
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1 04-2-MD14-13		1 3/1R		11 /		1 5	2
!		11 3/1R		11 /		1 5	1
1		1 3/1R		11 /		1 5	1
1 04-2-MD14-2		1 3/1R		11 /		; 5	1
1 04-2-MD17-1			NA NA NA	11 /		1 5	í
1 04-2-MD17-2	: APU-206	1 3/1R	P NA P	11 /	1	1 5	l i
: 04-2-MD19-1	1 APU-191	1 3/3	MA NA NA	11 /	1	: 5	1
04-2-MD19-2	: APU-188	3/1R	I P P P	11 /	i i	5	1 1
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04-2-MD19-2	:=== :================================	=;; ;;			_	_	; = ; ;	;====== (/	; ====================================	: 5	; =====:
04-2-MPU1-11	APU-112	1 1	2/1R	! P	P	P	ł	/	!	: 5	F .
04-2-MPU2-1	APU-113	1 1	3/18	! P	F	P	1	1 /	!	1 5] ;
04-2-MPU3-1	APU-114	: :	3/1R	! P	P	P	;	/	!	: 5	i
04-2-MV01-1	: APU-185	1 }	3/1R	; P	P	ρ	1	1 /	!	1.5	i i
04-2-MV01-2	APU-186	11	3/3	l N	A N	A NA	1	1 /	1	; 5	ł i
04-2-01XX-1	: APU-378	11	3/3	l N	A N	A NA	1	1	! i	1 5	!
04-2-PP11-10	: APU-128	11	1/1	l N	A N	A NA	i	1	1	1 5) 1
04-2-PP11-11	: APU-129	! !	2/1R	P	P	Ρ	1 1	1	1	1 5	!
	: APU-130	1 1	2/1R	: P	P	P	i i	/	;	: 5	1
	: APU-131	11	2/1R	! P	P	P	1	/	1	1 5	! i
	: APU-133	1 1	2/1R	: P	p	P	:	1		1 5	i ;
	: APU-135	!!	2/1R	l P	P	P	1 1	1	1	1.5	!
	: APU-13B	1 1	2/1R	l P	P	P	;	1 /	t i	15	!
04-2-PP11-3	: APU-132	11	2/1R	; P	P	P	11	/] i	1 5	,
04-2-PP12-11	: APU-187	!!	2/1R	; P	P	P	1 1	1 /	! 	1 5	!
04-2-8702-1	: APU-182	11	3/1R	! P	P	P	1 1	1	!	1 5	:
04-2-RV02-2	: APU-180	11	3/1R	; P	P	P	1 1	1	•	! 5	1
	APU-181	11	3/1R	P	Ρ	P	1 1	/	ł I	1 5	!
04-2-RV02-3	APU-183	1!	3/1R	P	P	P	1	/	1	1 5	; ;
04-2-S111-1	APU-110	!!	3/3	. N	A N	A NA	!!	/	1	1 5	1
04-2-S111-2	APU-111	11	3/3	: N	A N	A NA	1 !	1	; i	1 5	: : !
04-2-S112A-1	: APU-169	11			P	-	11		! !	1 5	
04-2-5112A-2	APU-170	11			ρ	P	11	1	!	1 5	i
04-2-S11A-11	APU-161	11	3/2R	P	þ	Ρ	11		! !	: 5	!
04-2-S11A-12	: APU-162	11			A N	A NA	! !	1	i	: 5	!
04-2-S14A-1	: APU-166	1 1	3/2R	; P	ρ	Р	! !	1	1 \	(5	!
04-2-514A-2	APU-167) ! 1	2/1R	! P	Р	Р	1 !	1	j i	† 5	!
04-2-S16A-1	: APU-164	11	3/2R		P	ρ	: :	1	i i	: 5	
04-2-S16A-2	: APU-165	: :	2/1R		p	p	1 1	1	!	15	!
04-2-S17A-1	APU-172	!!	3/2R	P	P	P	11	1	j i	15	
04-2-S17A-2	3 APU-173	11	2/1R	P	Ρ	Р	1 1	1	I	1 5	1
04-2-S18A-1	APU-211	11	3/2R	P	p	P	1 1	/) 	: 5	
04-2-518A-2	: APU-212	!!	3/3	: N	N	A NA	11	3/1R	PPP	! 1	X
04-2-TH11-11	: APU-276	11	2/1R	F	۶	P	11	f = f	! !	: 5	
04-2-TK11-11	: APU-115	11	1/1	: Né	N	A NA	1 1	I) i	; 5	
	: APU-116	11	1/1	N/	N	A NA	1 1	1	!	1 5	
	APU-117	11	1/1	. N	N	A NA	1 !	1] ;	1 5	<u> </u>
04-2-TK11-12	APU-118	!!	2/1R	P	P	P	! !	1	1	1 5 1	
04-2-TP11-11	: APU-156	1 1	3/3	N/	A N	A NA	11	1	1	1 5	
04-2-TP11-13	: APU-155	11	2/1R		F		11		!	! 5	
04-2-TR11-11	1 APU-103	; ;	2/1R		P	P	11		!	1 5	
	: APU-277	11	2/1R				11			1 5	
04-2-TR12-1	: APU-102	11				A NA	;;	1		1 5	
04-2-V12-13-1	: APU-143	! !	1/1	N	N	A NA	1 1	/ 1		15 1	
	: APU-144	11	1/1	N/	N N	A NA	1 1	1		15	
	APU-150	H	1/1	NA	i Ni	A NA	11	/ :		: 5	
05-4N-2000-1	: APU-326	! !	3/3	NA	N	A MA) (/ !	}	15	
	: APU-327	11	3/3	NA	N	A NA	11	/ :		5 1	
	APU-32B	11	3/3	M) Ni	A NA	11	/ :		1 5	
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		1 3	3/3	! N	A t	NA I	NA	!!	1	!		15 :
! !	: APU-332	1 3	3/3	1 1	A 1	NA	NA	; ; ; ;	1	i		15
<u> </u>	! APU-333 !	1 3	3/3	! N	IA A	NA :	NA	11	1	i		: 5
<u>:</u> 1	! APU-334	; 3	3/3	! N	A P	NA	NA	i i	1	1		1 5
	: APU-335	1 3	3/3	I N	A N	NA .	NA	: i	1	I i		1.5
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	: APU-337 :		3/3			NA		H	1	!		15
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05-6N-200400-2	: APU-300 :	1 3	5/3	: P	· F	P	P	1 }	1	!		1.5
	: APU-301 :	; ;	3/3	; P	ŗ	Ρ	Ρ	1 ;	1	NA.	NA NA	1 1 5
	: APU-303 :		5/3	P	•	P 1	P	1 1	1	i NA	NA NA	1 1 5
05-6N-200900-1	· · · · · · · · · · · · · · · · · · ·		1/3	i N	A I	NA .	NA	1 1	1	i		15
	1 APU-365 1		3/3			NA I		H	/	1		15
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05-4N-2014-2			7/1R	i P	·	F		; ;	1) }		15
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NASA FMEA NUMBER	ASSESSMENT NUMBER	HW/F		HW/F	SCREENS	OTHER (SEE LEGEND CODE)	ISSUE		
05-6N-2016-2		1 2/1R		1 /	1	; ; 5	!		
}	: APU-291	11 2/1R	! P	1 /	1	: 5	ì		
05-6N-2017-1	APU-292	11 3/1R	IPPP!	1 /	1	! 5	1		
05-6N-2017-2	APU-293	11 2/1R	: P	1 /	y F	1 5	i		
05-4N-2018-1	APU-294	11 3/1R	: P F P	1 /	1	1 5	†		
1	1 APU-296	3/1R	P NAP :	1 /	1	1 5	;		
05-6N-201 8- 2	(APU-422X	1 3/1R	1 F F P 1	/	f 1	1 5	!		
05-4N-2019-1	APU-295	11 3/1R	! P P P !	1 /	1	; 5	1		
05-6N-2022-1	: APU-323	3/1R	IPFP I	1 /	}	: 5	1		
05-6N-2022-2	APU-423X	11 3/1R	P	1 /	!	1 5	1		
05-6N-2024-1	: APU-362	1 3/3	i na na na i	1 /	!	: 5	1		
05-5N-2024-2	: APU-363	3/3	l na na na l	1 /	1	15	i i		
05-6N-2025-2	APU-424X	1 3/1R	IPFP :	1 /	1	: 5	1		
05-6N-2026-1	: APU-425X	11 3/1R	IPFP:	1 /	!	1 5	1		
05-6N-2027-1	: APU-322	1 3/1R	! P P P !	1 /	1	: 5	!		
05-6M-2029-1	: APU-320	11 3/1R	PFP:	1 /	!	: 5	1		
05-6N-2029-2	: APU-321	1 3/1R	PPP:	1 / 1	† 1	: 5	<u> </u>		
05-6N-2030-1	: APU-425X ·	11 3/1R	IPFP I	1 /	1	: 5	!		
05-6N-2030A-1	: APU-427X	1 3/1R	P F P	1 /	!	: 5	i I		
05-6N-2031-2	: APU-407X	3/3	NA NA NA I	1 /	!	1 5	!		
05-6N-2032-1	APU-297	1 3/3	NA NA NA I	1 /	i I	: 5	1		
05-6N-2033-2	: APU-42BX	: 3/1R	PFPI	1 /	!	; 5	1		
05-6N-2034-1	APU-286	1 3/1R		1 /	1 .	! 5	1		
05-6N-2035-1	: APU-2B0	11 2/1R	PPP:	1 /	!!	: 5	1		
	APU-281	1 2/1R		/	!	: 5	1		
05-6N-2035-2	APU-292	1/1	NA NA NA I	1 /	1	; 5	;		
	APU-283	1 1/1	I NA NA NA I	/	1	5	; ;		
	: APU-406X	1/1	MA NA NA I	1 /	1	; 5	i		
05-6N-2036-2	`APU-429X	1 3/1R	P F P t	1 /	!	: 5	!		
05-6N-2037-2	: APU-430X	1/1	NA NA NA I	1 /	!	5	;		
05-6N-2038-1	: APU-284	1 3/3	NA NA NA :	1 /	1	: 5	! •		
05-6N-2039-2	: APU-285	1 3/1R	PPP!	1 /	1	: 5	!		
05-6N-2040-1	: APU-309	1 3/1R	IPFP !	1 /	\$ 1	: 5	;		
05-6N-2042-1	: APU-305	1 3/1R	(PFP)	1 /	1	: 5	1		
	: APU-306	1 3/1R	IPFP!	l /		1 5	i		
05-6N-2042-2	: APU-307	1 3/1R :	PFP:	I = I	;	5	1		
		1 3/1R	PFPI	1 /	!	: 5	i		
05-6N-2043-1	: APU-420X	3/2R		1 /	1	: 5	;		
05-6N-2044-2	: APU-442X	1 3/2R				1 5	! i		
05-6N-2045-1		1 3/2R				: 5	!		
05-6N-2045-2	: APU-441X	1 3/2R	PFP	1 /		5	1		
05-6N-2047-1	: APU-357		I NA NA NA I	1 /		: 5	! !		
05-6N-2047-2		1 3/1R				5	! i		
		1 3/1R				: 5	i i		
05-6N-2048-2		1 3/1R 1				5] [
05-6N-2050-2	: APU-433X	1 3/1R	PFP;	1 /		; 5	i f		
05-6N-2051-2	: APU-361 :	1 3/1R 1	PFP	l /	:	1 5	; t		
05-6N-2055-1	: APU-348 :	1 2/1R	PPP:	1 /		; 5	; E		
05-6N-2055-2	1 APU-349 1	1 2/18	PPPI	l /	i .	5	ŀ		
05-6N-2056-2			FFFI		1	1 5	î L		
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NASA TOA	I IOA RECOMMENDATIONS *					
05-8N-2057-2	USSI					
15-6H-2059-42						
05-6N-2061-2						
05-5H-7063-1 APU-435X 13 3/2R P F P 11						
15-6H-2063-1						
155-6H-2064-2						
155-bh-2085-2						
15-6H-2066-2						
155-6H-2073-2						
135-6N-2074-2						
13-6H-2074A-2						
WINE APU-134						
APU-179						
APU-189						
APU-196						
APU-208						
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APU-217						
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1 APU-400 11 / 1 11 / 1 15						
! APU-417X						
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